

JOURNAL OF EDUCATION

Founded in 1875

Volume 195 • Number 1 • 2015

THE ARTS AND SCIENCES IN EDUCATION

Dedication

Roselmina Indrisano

Letter from the Editor

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What Mathematics Education Can Learn from Art: The Assumptions, Values, and Vision of Mathematics Education

Leslie Dietiker

Reflections on Teaching and Learning the Arts

A Middle-Grade Classroom

Rosemary Barilla

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Volume 195 • Number 1 • 2015

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In Memoriam

This issue of the *Journal of Education*, which focuses on the Arts and Sciences in Education, is dedicated to

Dr. Julie Mary Coppola

Clinical Associate Professor, Boston University School of Education

Guest Reviewer, *Journal of Education*



Exemplar of teaching as an art informed by science

Letter from the Editor

ROSELMINA INDRISANO, BOSTON UNIVERSITY SCHOOL OF EDUCATION

“Teaching is an art informed by science” was the explanation I offered several years ago in response to an interviewer’s question about how I would define teaching. More recently, as I wrote the dedication of this issue of the *Journal of Education* to our late colleague, Professor Julie Mary Coppola, I remembered the phrase as descriptive of the essence of her teaching. The interdependence of art and science in teaching is also reflected in the articles in this issue; each of them, whether focused primarily on art or science, affirms this relationship.

In the first article, Leslie Dietiker presents a unique perspective on mathematics education as she joins the art of the literary narrative with the science of mathematics to tell “a mathematical story” (p. 1). Readers are offered new insights that can be gained by “perceiving mathematics as a form of art” (p. 1). Inspired by the work of Elliot Eisner, a pioneer in arts education, she suggests to teachers and curriculum designers that “aesthetic ways of knowing” (p. 1) have the potential to renew and reform the “assumptions, values, and vision” (p. 1) of mathematics education. In telling the story, as would be expected of a mathematics scholar, she consistently raises questions about mathematics teaching and learning, but her rare blend of art and science results in queries that will engage and inform readers in other fields of study as well.

The next two articles feature the reflections of teachers and learners on the arts in education. Rosemary Barilla, a middle-grade teacher of the language arts, writes about her approach to infusing the study of the fine arts into the language arts. A close reading of her article also reveals the ways she relies on science in her teaching: for example, when she gives her students the opportunity to “read a building,” she asks them to attend to the structure as well as to the aesthetics.

Tina Boyer Brown, a department head at The Chicago High School for the Arts (ChiArts®), describes her school’s dual emphasis on the academic and the arts curricula, the former including traditional science courses that inform the intellectual development of the young artists who attend this school.

Both articles are enhanced by the reflections of students, among them Justin, an eighth grader in Rosemary Barilla’s class whose comment on his experience there reveals the contribution of arts activities to his conceptual understanding: “When many hands-on activities are woven into the lessons we are learning, the topic or lesson we are learning becomes clearer. We can grasp the concept more in our minds and analyze and critically think about it” (p. 13).

The discourse of science is the focus of the research reported by literacy educators Anna Maria Arias and Annemarie S. Palincsar

and science educator Elizabeth A. Davis, who combined their academic specializations to collaboratively address the “challenges associated with using text in science to promote general literacy skills and advance conceptual understanding” (p. 21). The researchers designed and studied “educative curricular supports for text-based discussions in science” that include “identified learning goals, discussion moves to support sensemaking with the text, and narratives of teachers’ uses of text in science teaching” (p. 21). In their article, the authors describe the design of the supports and report the outcome of elementary teachers’ use of them. At a time when disciplinary literacy is a central focus in national standards, this work will inform educators who are concerned with developing students’ competence in the literacy, language, and content of science and serve as an exemplar of effective instruction for those who work in other disciplines.

The final article, by Mark Percy, offers insights into how “the visual arts and media historically employed by teachers as a corollary to ‘traditional’ social education can play a more vital role in promoting critical inquiry among students” (p. 37). Using one short film as an example, the author proposes that visual media offer teachers and students opportunities to consider profound questions, including “What is justice?” which is the focus of the work he reports here. A close look at the stills of the film included in the text and at the film itself will leave few readers unimpressed by the science that made the images possible. As do others in this issue, this article suggests that the arts can be incorporated into instruction across the disciplines.

I close by returning to the speech by Elliot Eisner to which Leslie Dietiker refers in the opening article. In this address, Professor Eisner proposed that a central purpose of education is to guide students to become “individuals who have developed the ideas, the sensibilities, the skills, and the imagination to create work that is well proportioned, skillfully executed, and imaginative, regardless of the domain in which an individual works” (p. 4). Through their work, the authors of the articles in this issue will support our ongoing efforts to realize this goal.

Reference

Eisner, E. W. (2002). What can education learn from the arts about the practice of education? *Journal of Curriculum and Supervision*, 18(1), 4–16.

What Mathematics Education Can Learn from Art: The Assumptions, Values, and Vision of Mathematics Education

LESLIE DIETIKER, BOSTON UNIVERSITY

"It is the function of art to renew our perception. What we are familiar with we cease to see. The writer shakes up the familiar scene, and, as if by magic, we see a new meaning in it."

—Anaïs Nin (as cited in Cohen-Cruz, 2005, p. 86)

ABSTRACT

Eisner (2002) proposes that educational challenges can be met by applying an artful lens. In this article, I draw from Eisner's proposal to consider the assumptions, values, and vision of mathematics education by theorizing mathematics curriculum as an art form. Specifically, I argue that by conceptualizing mathematics curriculum (both in written and enacted forms) as stories, the mathematical lessons experienced by students can be artfully crafted to inspire wonder or grab attention through surprise. An example of a mathematical story from a Grade 7 mathematics textbook is presented and discussed. By framing mathematical content in narrative terms, I seek to enable a rewriting of mathematical experiences for learners.

INTRODUCTION

The *familiar* scene in most mathematics classrooms in North America is, sadly, not a stimulating one. Although several curricular reforms have largely resulted in revised content, mathematics as commonly experienced by students continues to be uninspiring and dull. Unfortunately, there is little evidence of improvement; what was referred to as "dry as dust" over 30 years ago (Davis & Hersh, 1981, p. 169) has more recently been described as "monotonous" (Sinclair, 2005, p. 1) and "flat-lined" (Gadanidis & Hoogland, 2003, p. 489). These characteristics—and the ramifications for students—are eloquently captured by Allen-Fuller, M. Robinson, and E. Robinson (2010), who quoted an anonymous prospective teacher after observing a Grade 10 mathematics class:

I don't know how they stand it. I couldn't stand it, and I wasn't even there all day. The lessons are so monotonous it makes you crazy. They just sit there and sort of listen or take notes or respond to the same leading, empty questions. I just thought with the *Standards* and all the new technology and everything that it would be better than when I was in school. But it's not. And yet, it absolutely has to be. *We can't just keep doing the same old thing.* (p. 231)

Clearly, as far as most mathematics courses are concerned, this scene needs rewriting. In this article, I suggest that by perceiving mathematics as a form of art, mathematics teachers and curriculum designers can "renew our perception" (Nin, as cited in Cohen-Cruz, 2005, p. 86) and avoid "doing the same old thing" (Allen-Fuller et al., p. 231).

Elliot Eisner, a pioneer in arts education, would likely agree that the arts could inform a re-imagining of mathematical experiences in classrooms. In a moving speech entitled: "What Can Education Learn from the Arts about the Practice of Education?" Eisner (2002) proposed that taking an artful approach to education could improve its quality and lead to a new vision for teaching and learning:

I am talking about a culture of schooling in which more importance is placed on exploration than on discovery, more value is assigned to surprise than to control, more attention is devoted to what is distinctive than to what is standard, more interest is related to what is metaphorical than to what is literal. (p. 16)

In describing this vision, Eisner (2002) declares his preference for *aesthetic* ways of knowing and learning. (An explication of the term, *aesthetic*, as used in the context of mathematics, is provided in a later section of this article.) Eisner challenges traditional assumptions regarding the planning of curriculum through the establishment of fixed end goals for which instructional means are then developed. He points out that artists develop and achieve their ends through their means, exploiting emerging and unexpected opportunities along the way. His vision of education as an art inspires new questions that serve to address some of its problems including: "How can the pursuit of surprise be promoted in a classroom? What kind of classroom culture is needed?" (p. 11).

Although the arts formerly enjoyed a central role in the educational vision of the United States, beginning in the 19th century, the educational perspective became increasingly more psychological, and as a result, more reliant on the scientific. The effect, Eisner (2002) laments, was that as problems with teaching and learning were identified, science became the *de facto* lens through which they were addressed. In his words:

In the process [of psychologizing perspectives on teaching and learning], science and art became estranged. Science was considered dependable; the artistic process was not. Science was cognitive; the arts emotional. Science was teaching, the arts required talent. Science was testable; the arts were

matters of preference. Science was useful; the arts ornamental. It was clear to many then, as it is to many today, which side of the coin mattered. As I said, one relied on art when there was no science to provide guidance. Art was a fallback position. (p. 6)

Eisner (2002) connects this shift toward science as an effort to “create order, to tidy up a complex system, to harness nature, so to speak, so that our intentions can be efficiently realized” (p. 7). However, as attractive as this goal may be, part of the problem with the mathematics classes described earlier may be that they are *too* tidy. Coming to understand a mathematical idea is generally not a tidy affair, as evidenced by written accounts of mathematicians. While formal mathematical texts (such as textbooks or proofs) may communicate in tidy ways, the human process of getting to understand the mathematical ideas in order to harness them is fraught with complications, dead ends, and happy accidents, as will be further explicated later in this article.

In fact, I propose that mathematics classrooms in which the work of teachers and students is *tamed* and *harnessed* are at their core something other than mathematical. Unfortunately, the mathematical work of building an understanding of mathematical ideas through the solving of emergent and interesting problems is never *efficiently realized* in most mathematics classrooms. Thus, Eisner (2002) suggests that turning toward science, with its drive toward uniformity and tidiness, will have limited potential value in helping to achieve his vision. He wrote,

What we can do is to generate other visions of education, other values to guide its realization, other assumptions on which a more generous conception of practice of schooling can be built. That is, although I do not think revolution is an option, ideas that inspire new visions, values, and especially new practices are. (p. 8)

Inspired by Eisner's (2002) intentions, I explore his triad of vision, values, and assumptions in relation to mathematics education. I start by challenging current *assumptions* about mathematics by describing what an artful, and thus aesthetic view of mathematics can look like. I then share my personal experience as a learner and teacher of mathematics to consider the *values* of mathematics education with respect to the current realities of teaching. Next, I draw from Eisner's artful *vision* for education to describe a new vision for mathematics curriculum by interpreting it as a form of art. Specifically, I present an interpretation of the mathematical content of curriculum through the lens of literature, that is, as a mathematical story. In the concluding section, I consider how artful interpretations of mathematics as stories can perhaps inspire new practices and thus offer a new scene for students.

Interpreting mathematics as a story repositions mathematics curriculum from an instruction manual or a collection of facts to a form of art, intentionally crafted to offer aesthetic experiences for a set of students, whether positive or negative. As Anaïs Nin (as cited in Cohen-Cruz, 2005, p. 86) suggests, this repositioning

offers the possibility of renewing our perception of the familiar mathematics educational form and hopefully, allows us to recognize and describe previously hidden qualities. My goal, at least in part, is to *shake up* conventional ways of viewing mathematics curricula as conveyors of content and aims, and to invite the imagining of rich new mathematical stories. If a novel can be appreciated for engaging characters or sudden surprises, why not a mathematics lesson that is experienced by students in a classroom?

ASSUMPTIONS REGARDING THE AESTHETIC DIMENSIONS OF MATHEMATICS

The aesthetic dimensions of mathematical teaching and learning have generally been ignored in research and theory (Sierpinska, 2002), perhaps because mathematics has been taught in such a sterile manner for centuries despite curricular reform efforts. To some, the monotony may even seem appropriate; the domain of mathematics appears to be the epitome of order and is highly valued for its precise syntax and carefully deductive structure of logical claims (Leron, 1985). Yet when the work of mathematicians is carefully scrutinized, a different scene plays out (Davis & Hersh, 1981; Hofstadter, 1992; Sinclair, 2006). The *aesthetic*, in part, guides decisions, motivates the pursuit of a particular line of inquiry, and helps mathematicians sense the correctness of a result before embarking on a proof (Sinclair, 2001). Because of this disconnect between the aesthetic experienced by those who study mathematics for pleasure (i.e., mathematicians) and that experienced by most students, in the next section I discuss the potential of the mathematical aesthetic of classrooms to challenge prevailing assumptions about mathematical teaching and learning and support a new vision for learning mathematics.

Eisner (2002) draws from Dewey (1934) who describes aesthetic as an individual's response to an experience rather than an attribute of an object. Dewey's framing helps explain how an object that is viewed as aesthetically pleasing to one individual will have the opposite effect on another (or even the same individual in different circumstances). Although the term aesthetic is most often applied to works of art, and therefore associated with notions of static beauty, Dewey notes that it is not an object's attribute but the individual's perception and interaction that is the locus of aesthetic. Dewey also suggests that aesthetic is contextual; it is the effect on an individual in the particular context that makes an object or event moving (or not), and this effect is generated as the individual takes in and makes something of the experience. Framed in this way, in any experience, aesthetic is both the force compelling one to move toward or away, to push forward or against. Therefore, Dewey explains, whenever we are compelled or repelled, it is this effect that makes up the aesthetic dimensions of experience.

With Dewey's (1934) framing as a guide, what can be said of the aesthetic of mathematical experiences that will inform a new vision for the teaching of mathematics? Mathematical aesthetic can generally be understood to be an individual's response to a mathematical experience, such as a sense of fit of a possible pattern or

insight into an underlying structure of a particular problem (Sinclair, 2001). In terms of exploring mathematics, then, aesthetic involves the sensing of value and truth and thus is part of what it means to think and understand mathematically (Burton, 1995, 1999). This includes being drawn toward a potential problem-solving strategy or sensing the correctness of a result. Thus, aesthetic is an essential dimension of any mathematical experience whether positive (i.e., stimulating) or negative (i.e., dull).

Throughout mathematical experiences, both professional and educative, an individual senses conditions (e.g., whether something feels complete or not) and is moved to affect them through mathematical means. These *movements* in mathematical work, while possibly very abstract, can feel embodied in the individual engaged in the mathematical experience, such as creating or maintaining balance (Lakoff & Núñez, 2000). Despite the common assumption that mathematics is a strictly rational pursuit, a mathematical experience can be a transformative, compelling enterprise of impulses and anticipation (see Hofstadter, 1992). Aesthetic is the motivating influence that can advance an individual (mathematician or student) through challenges and setbacks and dissuade the person from giving up.

How might a mathematics classroom take advantage of the potential aesthetic opportunities that mathematics offers? Sinclair (2001) defines “aesthetically-rich” learning environments as those that “enable children to wonder, to notice, to imagine alternatives, to appreciate contingencies and to experience pleasure and pride” (p. 26). This implies that “they legitimise students’ expressions of innate sensibilities and subjective impressions—they ‘work with’ such perceptions rather than exclude or deny them” (p. 26). This aesthetically-enhanced mathematics classroom includes multiple dimensions of mathematical experiences, such as connectivity, risk-taking, engaged imagination, sensory experiences, perceptivity, and activity (Uhrmacher, 2009).

Thus, creating *aesthetically-rich* mathematical classrooms requires *untidying* the mathematical experiences of students. Responding to Eisner’s (2002) call for a new vision of mathematics education will require new assumptions of the aesthetic opportunities and potential in mathematics learning. It necessitates shifting our primary focus from educational outcomes to moving experiences that have the potential to compel one toward an end. How might mathematical experiences for students be *rewritten* to allow for this possibility?

THE VALUES OF MATHEMATICS EDUCATION: A PERSONAL NARRATIVE

Eisner’s (2002) call for education to embrace the art of learning and teaching resonates with my personal experience of learning mathematics and my goals for teaching mathematics. It was largely the disconnect between my love and passion for mathematics and the forces that began to broadly shape mathematics curricular decisions that helped to shift my perception of mathematics curriculum to an art form. In this section, I offer my personal narrative of the

values of mathematics education in the hope that it will further ground the vision I describe in the realities of mathematics classrooms and the work of mathematics teachers.

For as long as I can remember, I have been intensely interested in mathematics and grew up seeking mathematical experiences outside the classroom. I sought out mathematical puzzle books (my favorite section of the bookstore) and spent multiple evenings on the same challenging problem or puzzle. From these experiences, I became aware that a problem or puzzle could grab my attention, raise larger questions, require me to renegotiate the way I understood a mathematical idea, and invite me to anthropomorphize mathematical objects. In a very real sense, the numbers and shapes I encountered were friends and enriched my daily experience as much as color or music.

I continued my study of mathematics in college and decided that I wanted to share this passion with students. When I began teaching mathematics, I was fortunate to find a position at an inner city high school in San Francisco that allowed me to engage with students in what I now think of as *mathematical adventures*. These adventures, which are a contrast to the typical mathematics lessons described at the beginning of this article, were often sparked by a student’s question or an unexpected result, and usually no one knew how the adventure would end until we jointly arrived there. I aimed not only to help students learn content, but also stimulate their (and my own) interest and enthusiasm for the possibilities ahead of us. It was through working with these students that I recognized that mathematics could be understood in many different ways and learned that the students’ experience and anticipation for what was to come were equally as important as my learning objectives.

Early on, I remember working with colleagues on curricular questions that I now interpret as trying to recognize (read) the mathematical story of our textbook as well as develop new experiences with mathematics, questions such as: How does this mathematical idea develop? How could I make this more mathematically inspiring? What if I changed the order of the parts of text, such as lessons or even chapters? At this time, the curricular focus was not only on making learning stimulating and enjoyable, but making *mathematics* stimulating and enjoyable. Curriculum choices were made in relation to overall development, and students’ understanding was viewed in relation to where we were in the broader story.

My changing view and thus my use of the mathematics curriculum, required more than *following a textbook*, and soon I was critiquing the design of my lessons, asking questions such as: What could help make the focus become important to the student, so that it’s the student’s question and not my own? I relished designing experiences that would enable students to gasp in surprise at the mathematics and beg further exploration. Not that this would always happen, but the aim was always there. I wanted students to experience mathematics in a way that showed that it could be exhilarating, surprising, captivating, and full of wonder (see Sinclair, 2001). This commitment eventually led me to write mathematics textbooks for middle and high school, which allowed me to re-imagine what a curriculum could offer teachers and students.

I began to notice how different parts of a story could affect what came before and what came after. I also became much less interested in replicating existing curricular sequences (assuming, for example, that an algebra course had to start with a review of arithmetic) and recognized that, though not unbounded, there is great flexibility in the ways mathematical ideas can be sequenced. In the next section, I provide an example of a *mathematical story* from one of these textbooks (see Figure 4).

Between 1995 and 2005, the constraints on teaching mathematics in the U.S. underwent a dramatic change. The curricular freedom that enabled me to create inspiring mathematical experiences for my students vanished. What little public attention had been given to the aesthetic of mathematics learning and teaching evaporated. In conversations with mathematics teachers throughout the country, both colleagues and those I met at conferences and professional development sessions, it seemed that as a result of newly mandated learning expectations (e.g., state standards and district curriculum guides), content outcomes became the dominant theme. Sadly, I believe that if I had started teaching today, I do not think I would have had the curricular space and freedom to *play* with the aesthetics of my lessons.

Although discussions of teaching included pedagogical considerations, particularly with the influence of the NCTM standards (National Council of Teachers of Mathematics [NCTM], 2000), I became concerned that the content sequence and particularly its potential aesthetic opportunities for students, was rarely part of the discussion. I wondered why many of the teachers I met through professional development, who had earned my respect, rarely questioned their textbooks. There was often an ambivalence regarding a choice of sequence, as though some thought that: As long as the content is there, designed in a way I prefer, and covers the material before the high-stakes assessment, who cares if Chapter 1 starts with X instead of Y? Even when I tried to convince my colleagues that mathematical sequence is worthy of attention, I realized how difficult it was to discuss. There are few ways of conceptualizing and describing the nuances of mathematical changes throughout a lesson, let alone a unit or chapter, particularly with regard to dimensions on which I had relied so much in my textbook design work. Any attempt seemed only to scratch the surface, recognizing only *sequence* but not its *consequence*.

Through all this, I have come to suspect that the void in terminology describing how mathematical experiences compel or repel may be contributing to the current lack of attention on the aesthetic dimensions of mathematics curriculum. To address this lack of vocabulary, I assert that the mathematics education community needs to look outside our field for ways to recognize how mathematical content can inspire wonder and stimulate curiosity. To build this new vision for what mathematics curriculum can be, I turn to the arts—and specifically literature—for new language.

A NEW VISION FOR MATHEMATICS EDUCATION: MATHEMATICS AS NARRATIVE

It is reasonable to ask why I look to literature rather than other forms of artistic expression. Although mathematics is often described as the opposite of artistic expression, some casual connections can be identified. For example, geometry, with its focus on shape, can readily be connected to the visual arts such as drawing and painting (e.g., Escher, Mondrian), sculpture, and architecture. In addition, the manner in which a lesson is *composed* and *performed* by a teacher and students can be interpreted as different renditions of the same orchestral score (see Brown, 2009). The way in which the different strands of mathematics (e.g., measurement, number, shape, and algebra) are interconnected throughout curricula can be viewed as a woven art. Since mathematics exists to describe the world around us, it is likely that nearly every visual or performing art offers potential metaphorical language for structural and aesthetic qualities of mathematical experiences.

However, I suggest that stories are particularly suitable as an art form for mathematics curriculum as they are at their root pedagogic in nature. History abounds with examples of stories meant to teach important lessons of life (e.g., parables in the *Bible*). Stories integrate both logic (e.g., Does the story make sense?) and aesthetic (e.g., Does the story move me to continue reading?). While each of the other art forms offer elements of value that draw attention to particular aspects of mathematics, a narrative perspective also combines the temporality (i.e., how a story unfolds) and the message (i.e., the moral of the story) of curriculum. Stories conjure fictional worlds for which truth is self-contained, much like mathematics.

Egan (1988) argues that curriculum broadly, mathematics curriculum included, can be organized as stories and claims that this form can help students make meaning of the content. He offers an example of a mathematical story lesson, where students are told an “historical” story (a king’s counselor needs to organize marbles in bowls to count the size of an army), and new content (place value) is required to solve a human problem. In this way, Egan proposes to embed mathematics content in a fictional story problem. However, Egan goes beyond the traditional argument that this strategy motivates because stories with mathematics connect students to the so-called *real world* or how the world is assumed to be. Instead, he argues that by drawing from the historical origins of the mathematical content (i.e., the problems the content was developed to solve), mathematical stories may engage students with imagining how the world once *might have been*.

However, Egan’s (1988) notion of a story assumes that characters are human and the setting is the historical past in our world. In this vision, mathematics curriculum would appeal to students through an historical perspective. However, what would it mean to a reader if a mathematical story is not about fictional humans, but instead about triangles or systems of equations? How could the content of mathematics lessons, such as derivatives or arithmetic expressions, be viewed as a story?

A different approach was taken by Netz (2005), a mathematics historian, who used narrative as a way of comparing the different aesthetic dimensions of the content organized within ancient Greek mathematical texts. For example, he points out that Euclid, in *Elements*, offers an incremental sequence of layering propositions in a way that allows a reader to advance in a smooth and predictable cadence. In comparison, Netz shows that his reading of Archimedes' *Sphere and Cylinder* was anything but smooth and predictable. With puzzling turns and surprising conclusions, Archimedes offers a different mathematical experience. To explain this perspective, Netz asserts:

The concept of “narrative” applies almost directly to mathematics, in that mathematical works—just like many other works of verbal art—tell a story: they have characters, and our information about the characters gradually evolves. (p. 262)

Therefore, the work of Netz suggests that attending to mathematics as a “verbal art” could offer insight into how mathematics curriculum might work to inspire and transform the reader/student. If mathematics curriculum is interpreted as a story, what might that look and feel like? What do we learn?

Sinclair (2005) offers an instructive strategy. In an argument that mathematics textbooks are unnecessarily devoid of inspiring and thought-provoking experiences for students, she proposes that mathematics texts can be read as drama using the effect of a Greek chorus. To demonstrate, Sinclair shares her dramatic reading of a proof of the irrationality $\sqrt{2}$ of as seen in Figure 1, offering interpretations such as those in Figure 2.

Figure 1. Sinclair’s (2005) Proof of the Irrationality of $\sqrt{2}$

Suppose $\sqrt{2}$ is not irrational

Then $\exists p, q \in \mathbb{N}$ such that $p/q = \sqrt{2}$ and $(p, q) = 1$

So $p^2 = 2q^2$,

Then $2 \mid p^2$,

And $2 \mid p$.

Therefore, $p = 2r, r \in \mathbb{N}$

So $2q^2 = (2r)^2 = 4r^2$ and $q^2 = 2r^2$

Then $2 \mid q^2$,

And $2 \mid q$.

Contradiction, since p and q were supposed to be relatively prime, \therefore There does not exist p and $q \in \mathbb{N}, (p, q) = 1$ such that $p/q = \sqrt{2}$, $\therefore \sqrt{2}$ is an irrational number.

Sinclair’s (2005) interpretation is consistent with Bruner’s (1996) notion of narrative thinking, which suggests that individuals construct personal narratives when trying to make sense of an event or idea. In this sense, reading a proof is construed as reading for interactions between parts, looking for what connects each statement in a coherent string. The reader is drawn to certain objects with certain properties that are revealed over time. Questions arise that are not immediately answered, but all are posed to make sense

Figure 2. Sinclair’s (2005) Narrative Reading of the Proof of Irrationality of $\sqrt{2}$

Well, if $\sqrt{2}$ is rational, I should be able to write is (*sic*) in a fractional form, as p/q . But if I can write it as p/q , I could also write it as $100p/100q$, and a million other ways, so let me honour my characters by introducing them in their barest form, in reduced form. (narrative reading, para. 1)

I can’t get a sense of what that q^2 has to do with anything, so let’s write $p^2 = 2q^2$. Aha! Now I’m getting somewhere. This looks nice: nothing is hidden in root signs or in denominators, and p has emerged as the leading actor on the left—the struggle, of p^2/q^2 , now has a hero. (narrative reading, para. 2)

So far, so good. Our hero, p , big and natural and even, sure-footed and strong. Now what about that dastardly q ? Can I rearrange my equation again? Unmask him in his perfidy? Maybe give q a starring role? Hmmm. Even if I write $q^2 = \frac{2}{p^2}$, it doesn’t give me anything useful. How can our hero help? Well! since p is even, he can disguise himself as $2r$, where r is some passing natural number. (narrative reading, para. 3)

of the parts in relation to the whole, that is, what each statement tells us in relation to prior statements and how they relate together to address the larger question (e.g., Is $\sqrt{2}$ irrational or not?).

Admittedly, mathematics curriculum is quite different in form and function from ancient mathematics texts of Euclid and Archimedes and contemporary proofs. Yet mathematics curriculum also has potential ties to narrative. For example, there is evidence that mathematical word problems can provoke the imagination, which might engage the reader in unexpected ways. Pimm (1987) offers the example of author David Roth who described becoming engaged with the details unmentioned in word problems. After being challenged with a word problem involving a discount on a coat, Roth professed wondering about unaddressed questions, such as, “To whom had the haberdasher finally sold the overcoat?” (p. 14). This demonstrates the perlocutionary effects mathematics curriculum can have on a reader, and that, though these vary by reader, they can include the raising of questions as well as the stimulation of imagination.

Mathematics Curriculum as Stories

Beyond word problems, which have an obvious connection with stories, I propose that the mathematical content of lessons found broadly in classrooms and in textbooks can also be interpreted in narrative terms, and that this offers new artistic tools for teachers and new mathematical opportunities for students. In this section, I provide an overview of this artful interpretation of mathematics curriculum before focusing on the implications of this proposal.

Drawing from the narrative theory of Bal (2009), I analyzed a variety of mathematical textbooks from the U.S. and Singapore to develop an interpretation of mathematical sequences

that correspond to the dimensions of narrative (Dietiker, 2012). Through this work, I came to recognize mathematical stories as the way in which the mathematical content unfolds for a reader across written or enacted curriculum. That is, a mathematical story is an interpretation of how the mathematical content emerges and changes throughout a sequence of events. Rather than viewing mathematics as a static set of theorems and definitions, this interpretation focuses on the reader's dynamically changing mathematical understanding of the ideas under discussion.

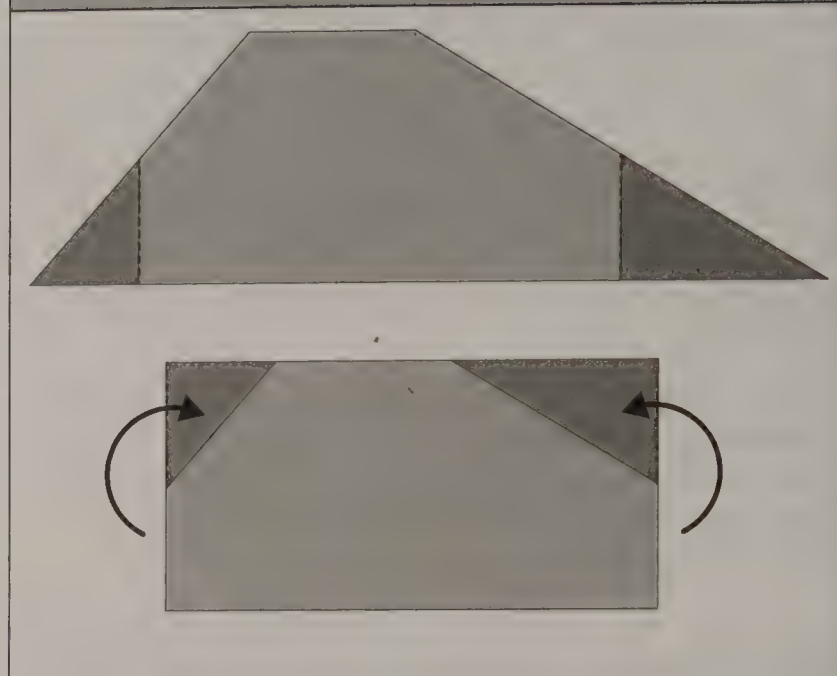
Using this perspective, the characters in mathematical stories can be recognized to be the mathematical objects that emerge explicitly and implicitly during the temporal unfolding of content. For example, an entire lesson in algebra might be about a family of quadratic functions and their relationships. Or a lesson in elementary school may focus on a set of fractions to determine how to order them from smallest to largest. In fact, when viewed this way, an entire course can often be recognized to be about a handful of mathematical characters, such as the numbers 0 and 1. This realization was behind one teacher's note to me about a geometry textbook I coauthored:

I remember the second time I finished [teaching with a geometry textbook]. On one of the last days of school we found the equation of a circle using a right triangle. At that point I realized that the whole [geometry] book was about a triangle. The better part of this story was when I shared this realization with my students they all said, "We know." (Personal Correspondence)

But just as a literary story cannot be about characters only (for example, one that begins and ends with "Once upon a time, there were three little pigs and a wolf."), a mathematical story must have action(s) that enable(s) change in order to move the story from the beginning to the end. Mathematical action, therefore, can be thought of as what happens to the mathematical characters in the mathematical story. For example, adding 3 and 5 enables a new mathematical object to emerge in the mathematical story (the number 8). Decomposing a trapezoid into parts and rearranging into a rectangle (see Figure 2) enables its area to be calculated. Beyond the operations (i.e., addition, subtraction, multiplication, and division), mathematical actions common in K–12 classrooms include transformations (e.g., rotating, translating, and dilating functions on a coordinate plane), rewriting (e.g., combining like terms or factoring), and composing/decomposing mathematical objects (e.g., "borrowing" 10 from the hundreds place to aid in subtraction). Without mathematical action, the story has no plot.

Another dimension to stories is the setting, where the characters and actions occur in various spaces described by the narrator (Bal, 2009). In mathematical stories a setting can be thought of as the space in which the mathematical characters and actions are found. For example, the mathematical story might occur with symbols on a page or with square tiles on a desk. A linear function might be presented in a table or on a coordinate plane. A mathematical story could play out on a calculator or physically with a student hopping

Figure 3. Decomposing and Recomposing a Trapezoid to Find Its Area



on a number line on the floor. Imagining mathematics curriculum as a story opens up the possibility of reimagining the mathematical activities by changing the setting. Interpreting mathematical content as narrative allows new questions to become driving forces for curriculum planning, for example:

- How might deliberate choices of representations of mathematical objects, (e.g., introducing negative numbers in the context of temperature or with two-colored tiles, where one side represents $+1$ and the other represents -1), affect the notion of negative numbers?
- How do these choices affect later portions of the mathematical story? What changes in the story (and thus, how we come to understand the mathematical ideas) if the mathematical setting for studying addition and subtraction is changed from a number grid (a chart in which integers are arranged in successive rows of 10) to a number line (integers represented in a single line stretching indefinitely in two directions)?

These questions and others enable the focus on key aspects of mathematical study: the mathematical objects and relationships, procedures, and representations.

Mathematical Plot: The Mathematical Impulse of Mathematical Stories

This article opened with a call for the need to rewrite the mathematical stories of our classrooms. Although the ability to reimagine the mathematical objects, procedures, and representations in new ways can open new opportunities for learning mathematics, the initial critical questions are: How might the aesthetic dimension of mathematical stories be understood and improved? How might a story that will move a student to wonder or pursue a particular line of inquiry be conceptualized?

One way a literary story can grab and hold attention is plot: how it temporally reveals and withholds information to provoke a reader

to use what is known at each point of the story to ask questions about what is not known (Brooks, 1984; Nodelman & Reimer, 2003). A plot describes the temporal pull of the reader to anticipate what will happen and connects the logical (what is known) with the aesthetic (how it moves the reader). Therefore, rewriting mathematical experiences to *shake up* the familiar scene involves the *mathematical plot* of the mathematical story, creating the tension between what is known and not known by a reader throughout the temporal unfolding of the curricular sequence. In terms of a mathematical story, anticipation occurs when a reader can imagine a future result through the continuation of a pattern or structure, with a vision of closure (e.g., what a solution might look like). This is not to say that all readers will find the same mathematical story aesthetically pleasurable, only that there are mathematical impulses that can drive a reader to actively continue with the story.

However, designing mathematical lessons that allow for student anticipation for what is to come does not mean that *aesthetically-rich* mathematical plots require predictability. To the contrary, it is the *feeling* of anticipation of how the mathematical story *might* play out that matters. In fact, it is when this anticipation turns out to be false that surprise is possible. Plot twists are so named because they represent deviations from an expected path. Literary authors deliberately design sequences of events to enable particular assumptions that later will be revealed as false, and as I'll next show, mathematical stories can be designed similarly.

Consider the following example of a mathematical plot based on a lesson in a Grade 7 textbook, shown in Figure 4, for which I was a co-author (Dietiker, Kysh, Sallee, & Hoey, 2010). This lesson, adapted for length, was designed to introduce the notion of a fair game. To follow the discussion regarding the mathematical story the reader is encouraged to engage in each task in the given sequence.

This lesson can be interpreted as a mathematical story because there is a clear beginning (with a discussion about winning games with strategy) and a sequence of connected events moving the story forward:

1. Discussing what might happen in a game in Task 1
2. Playing the game with friends and analyzing the results in Task 2
3. Playing the game against the teacher with a conjectured strategy in Task 3
4. Changing the game so that it is equally likely for each color to "win"
5. A resolution (learning about the outcome of the game and how to predict the outcome)

The setting of this story is a particular game with given rules played on a given game board, and this particular setting limits all the mathematical actions and characters within the mathematical story. This is a mathematical story about colors, which mathematically can be recognized as locations along a number line from a starting position. The game focuses on the probability of landing on each of the locations with three flips of a coin. Therefore, these positions and the probabilities of landing on each are the mathematical characters of this mathematical story. The mathematical

Figure 4. A Set of Tasks Adapted from *Making Connections*
Course 1: Lesson 1.1.2

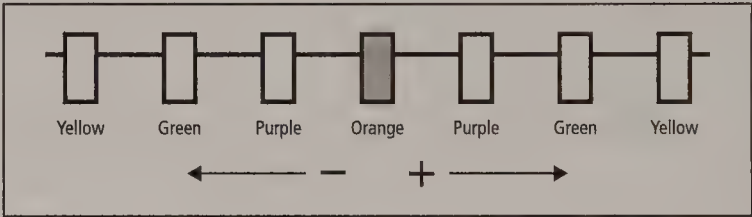
1. Have you ever watched people win a game again and again? Do you think these people just have good luck? Sometimes, winners have a strategy that increases the chance that they will win. How can you develop a winning strategy? Today you will start to answer this question.

Your teacher will challenge your class to a game of Color-Rama! To play, a marker will be placed on the orange space on the board below. Your class will need to select *one* color for your class and a *different color* for your teacher. Then a volunteer will flip a coin three times. If the coin lands with the "+" showing, the marker will move one space to the right, and if the "-" is showing, then the marker will move one space to the left. If after three flips, the marker is on your class's color, your class wins! If it lands on a color no one picked, then no one wins. Which color should you choose?

Before you play, discuss the questions below with your team. Then move on to task 2.

Does it matter which color is chosen?

Are all the colors equally likely to win? How can you decide?



2. If you want to win, is one color a better choice than the others? Is there a color that you should not pick? To decide, play the game several times and be sure to select a different color each time. What do you notice?
3. Now is the moment you have been waiting for! Play the game with your teacher. As a class, choose a color your class and a color for your teacher that will give you the best chance at beating the teacher.
4. What makes a game fair? Discuss this with your team members.
 - a. Is there a way to change the rules of Color-Rama to make it a fair game? Decide on any changes to the rules that you would recommend.
 - b. Play the game a few times with your new rules. Be prepared to describe to the class the changes you made and explain your reasons for making the changes.

(Dietiker, Kysh, Sallee, & Hoey, 2010, pp. 10–12; used with the permission of the publisher)

actions of this game are varied but include flipping a coin and moving a marker as well as changing the rules of the game (in Task 4) to make it equally likely that each player can win.

So, what is the mathematical plot of this mathematical story? To answer, the question can be rephrased: How might this mathematical story compel a student/reader in parts of the lesson to be interested in the final outcome? Although any seventh-grade student entering this lesson will bring prior knowledge unique to that individual, it can be assumed that the person recognizes that using a coin to decide if the marker moves to the left or right makes it equally likely that the marker moves in either direction. This recognition is important because it creates the opportunity for the student to make a false assumption: that all locations on the board are equally likely. Even students who take a more analytical stance at the beginning of the mathematical story are potential victims of another faulty assumption; since it is equally likely to move right or left for each flip, the “average” move can be interpreted as not moving at all. That is, each pair of flips can be assumed to have the effect of not moving as the move in one direction can be undone by a move in the opposite direction. In my experience, students with this perspective have come to one of two conclusions: either they decide that “orange” is the best guess (because it represents the center or balance point of the game board) or that “green” is the best guess (because green represents the “average” location on both the right or left of orange because it is found in the middle position between purple and yellow).

Regardless of which faulty assumption a student may make, the student is then able to be surprised when data are collected in Task 2 to show that the marker never lands on green or orange after three flips of the coin! Therefore, it can be expected that key probabilistic questions such as: How is that possible? and Why does that happen? will be generated by the students during the mathematical story because of the contradictory evidence that emerges during of the sequence of events. These emergent questions reflect motivation for figuring out the probabilistic nature of this game and the result when students become invested in the outcome of the story.

Therefore, it is important to note that although this mathematical story has many explicit mathematical questions in the form of curricular prompts, the implicit questions: How is this possible? Why does that happen? are not in the text. Yet the mathematical plot relies on these key implicit questions to compel the reader to dig deeper in Task 2 than just making casual observations from the data.

The implicit questions derived from the contradiction also serve other important purposes of this lesson. To answer these questions, students are compelled to reason deductively about the potential outcomes of the game. These questions encourage students to determine and compare the probabilities of landing on the colors in order to “believe” what they “see” in Task 2. The answers to these implicit questions also support reasoning about what it means for a game to be fair, an understanding which supports students when they consider ways to alter the game in Task 4 to affect the probability of winning.

In summary, the mathematical plot of this mathematical story is the increase of tension felt by a reader from Task 1 (when a deceptively simple game is offered) to that felt in Task 2 when the

student readers who think they know what will happen in the game are confronted with contradictory evidence that shows them they were deceived. This increased tension between what is *known by the students* (or in this case what is known about what they don’t know!) and *what they want to know* (the best color to choose) potentially motivates the student forward in reasoning about the game. This tension remains until there is resolution through deductive reasoning (e.g., proving to oneself that the marker can never land on orange or green after three flips of the coin, and that landing on purple is more likely than landing on yellow) and the game between the students and teacher is finally played in Task 3. Then, in Task 4, students gain a new perspective on the aspect of the game that created the tension, specifically the lack of fairness (i.e., that what appeared to have an equal chance, in fact, did not). The opportunity to alter the game at the end of the lesson allows students to create new potential dramas for future imaginary game players. Thus, the students are invited to *rewrite* the game.

This analysis makes no claims about *who* would read a mathematics textbook this way, but suggests that a mathematics textbook *can be read* this way. This distinction is important because there are multiple factors (e.g., the way textbooks are addressed and used in a classroom) that possibly discourage some readers (i.e., students) from recognizing a sequence of a mathematics text as a mathematical story. Even though some mathematicians and math educators recognize the possibility of mathematical plot, this does not mean that all or even most readers will do the same. It is important to emphasize that the purpose of this way of imagining curriculum is not to explain how students and teachers read mathematics textbooks, but to re-conceptualize mathematics curriculum in a way that can support the curricular design work of teachers and open new mathematical possibilities for students.

“SHAKING UP” THE FAMILIAR SCENE IN MATHEMATICS EDUCATION

Tapping what we know about literary stories offers new curricular insight. For example, consider how an unanswered question about a literary character that is sustained throughout a story can make that story compelling (e.g., Is a character in a familiar story good or evil?). How might this comparison inspire new types of mathematical stories centered on the development of mathematical characters? The framing of mathematical characters foregrounds new questions about mathematical objects within curriculum that can lead to aesthetic opportunities: What type of mathematical characters might provoke mystery? What qualities of mathematical characters could remain in question for sustained portions of the curriculum? In what ways might a mathematical object offer surprise, such as the seemingly uninteresting quadratic $x^2 - 6x + 3$, which has a central role in a mathematical story in Dietiker (in press)? How might a story be based on a group of related mathematical objects for example, a pattern of numbers (see Dietiker, 2013)?

To determine what might not be a compelling or coherent narrative in mathematics curriculum, it is instructive to think about what

doesn't work in literary narratives. Stories that seem to have no point, offer nothing for a reader to anticipate, or are easily predictable are quickly abandoned. Serials sometimes attract a reader's interest at first but then lose it once the reader sees that all the episodes feel the same. When the mathematical stories of mathematics classrooms are analyzed, how many of these qualities are noticed?

The current lack of new ways to talk about curriculum may explain why so many U.S. textbooks offer the same scope and sequence. A survey of most algebra texts will show that the study of linear functions comes before quadratics, solving equations before inequalities, etc. But is this order necessary, or even advantageous? What advantage or disadvantage might there be in changing this order of content? In some cases, I propose, this sequence exists only because this is the way it has always been done. However, other orders may enable different mathematical connections to be recognized or may draw attention to particular mathematical relationships in a useful way. Potentially, this new conceptualization of mathematics curriculum enables the exploration of other major (and minor) changes in the mathematical sequence.

However, the potential for curricular reform goes far beyond major or even minor changes of sequence. Just as a fiction writer carefully chooses the moment in a story to introduce a character or to reveal "who done it," so too might a teacher deliberate on the point in a sequence to introduce mathematical objects or reveal important properties or relationships. Similarly, just as placing a setting of a story in a particular locale can offer particular affordances and constraints, so too can the decision to set the study of integers on a number line versus two-colored tiles. Therefore, a potential benefit of this way of interpreting mathematics curriculum is to offer a conceptual foundation on which teachers and curriculum designers make mathematical choices regarding objects and representations.

Importantly, this conceptualization offers new ways to compare stories and describe them. For example, perhaps a mathematical story is found where the resolution is the invention of a new mathematical character (e.g., $\sqrt{2}$). What other stories might also be described as a "man-hunt," the search for a character with particular qualities? Or, perhaps a story has a particular shape, which could be described as a "character study." What mathematical stories might fall into this category? Future work could examine the mathematical forms of stories and how these different forms are useful and beneficial to students for different goals and purposes.

Once possible genres of mathematical stories emerge and are articulated, new questions can be explored: If we look at the genres of mathematical stories found within a textbook, what type of variation is found? What might be the role of variation of mathematical story genres? Do certain genres lead to improvements in learning or retention by students? Are there forms or genres that are noticeably missing and could lead to the exploration of new mathematical stories? While this framework speaks to the mathematical stories found in textbooks, we might also ask: What mathematical stories are "told" in our classrooms? What mathematical stories do the students perceive?

CONCLUSION

The meaning and effect of sequential temporal experiences have been theorized and rigorously studied in terms of novels and short stories alike but have so far been ignored in regard to mathematics instruction. Although it may be unorthodox to consider mathematical objects and activity in these *novel* ways, conceptualizing the unfolding of mathematical content in a textbook as a mathematical story allows new questions to emerge. With this work, I aim to promote new and deeper curricular understanding of textbooks and inspire teachers and other curriculum designers to imagine and enact new powerful mathematical stories for students. As described in the opening of this article, the mathematical stories in most mathematics classrooms are unfortunately neither inspiring nor compelling. Therefore, paraphrasing Eisner's (2002) point, mathematics education has much to learn from art about constructing compelling mathematical experiences for students.

Herein lies the hope. With this new conceptualization of mathematics comes new opportunities. During my professional development work with practicing mathematics teachers, I am encouraged that this framing of mathematics spurs them to reflect on the types of mathematical stories they have been constructing with and for students in the past. An artful interpretation of mathematics allows both its overall structure and its aesthetic dimension, in textbooks and in the classroom, to be recognized and improved. It provides the opportunity to finally change reality for many students, who are often condemned to mathematical stories that are "the same old thing" (Allen-Fuller et al., 2010, p. 231).

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Reflections on Teaching and Learning the Arts: A Middle-Grade Classroom and a High School for the Arts

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A MIDDLE-GRADE CLASSROOM

ROSEMARY BARILLA

ABSTRACT

In this article, Rosemary Barilla, a middle-grade language arts teacher, inspired by her own dedication to the arts, describes the ways she integrates the fine arts into her classroom program that is designed to teach reading and writing. She notes,

My priority is to address and teach the language arts standards, and I believe that to do so in good faith is to teach a well-versed understanding of how to “read” and write various texts, whether the text is in the form of a painting, a song, a play, or a novella. (p. 12)

INTRODUCTION

One day last year, I walked out of my school building as I did each afternoon, but this time the sound of music made me turn my head. Imagine my surprise as I saw an upright piano turned on its side near the school’s dumpsters and heard the keys being played. I approached to find a student, hidden as he stood behind the piano, playing a tune on the vertically positioned keys. This piano had resided in Room 101 for more years than I would know, was played for hundreds of kindergarteners, and eventually acted as a table for piles of papers and teachers’ manuals. There was a time when every Chicago Public School kindergarten classroom had a piano, and teachers were required to know how to play the instrument



May 15, 2014, “By the Dumpster”

and sing with their students. I was struck by how the student I observed chose to plunk out a poignant tune on something that was consigned to waste, and I silently renewed my resolve to share my dedication to the arts with my own students.

OUR SCHOOL

The Students

Jamieson is a Chicago public city school district elementary school with just over 900 students, preschool through eighth grade. It is more commonly known as a “neighborhood school,” or one that serves students within the immediate geographic boundaries designated by the Board of Education. The students represent a diverse community. The most recent data show that the enrollment is comprised of students from the following groups: 77% low-income families, 13% diverse learners, and 29.5% limited English learners. These demographics are indicative of the various ethnic groups within the neighborhood: 25.9% Asian, 3.9% Black, 34.4% Hispanic, 31.4% White, and 4.5% Other. The school is designated a Level 1+ school under the School Quality Rating Policy, a district rating policy that uses multiple data sources such as standardized tests, attendance rates, and academic growth to gauge school performance (www.cps.edu/Performance/Pages/PerformancePolicy.aspx). The rating indicates a school’s performance level and determines an Accountability Status of “Good Standing,” “Remediation,” or “Probation.” These designations further determine what legal measures will be taken by the Board of Education to intervene in the school and “to correct academic deficiencies” (www.cps.edu/Performance/Documents/SQRPHandbook.pdf). Jamieson has an Accountability Status rating of “Good Standing,” which is given to schools that are “bound by federal and state law and CPS policies, but retain certain autonomy with regard to school improvement planning and budgets” (www.cps.edu/Performance/Documents/SQRPHandbook.pdf).

The Arts

Principals in our district are positioned to make challenging decisions regarding their use of the allocated per-pupil budget, including the salaries of teachers and staff, the cost of substitute coverage, and materials such as textbooks. Limited funding places pressure on each principal to prioritize core instruction over the fine arts. Currently, the faculty includes an art teacher and a music teacher, not uncommon in a neighborhood school where all students have a class in these subjects courses during their once-a-week fine arts instruction. According to the CPS school report card page on Creative Schools Certification, our school is rated “strong” in five categories. “Strong” is the second-highest rating, given to a school that “nearly meets the goals and priorities outlined in the CPS Arts Education Plan, including Staffing & Instruction, Partnerships, Community & Culture, and Budget & Planning” (www.cpsarts.org/creative-schools-categories/).

Within the last two years, the CPS Department of Arts Education has implemented a plan to have arts liaisons in schools. This year, our newly appointed art teacher is our designated art liaison. According to the current definition, arts liaisons are “school-based champions that lead, connect, and inspire robust arts programming in their building” (www.cpsarts.org/creative-schools-certification/). The goals of the certification process are to connect schools with grant opportunities in order to facilitate more arts programming and to support arts programming within individual schools over time in the following areas: staffing and instruction, partnerships, and budget and planning (www.cpsarts.org/creative-schools-categories/). Thus far, we have not received any grants for this purpose; however, our Local School Council—the parent, staff, and community organization that approves individual school budget spending and renews administrator contracts—requested and procured a portion of the school’s budget to bring the director of the Chicago Children’s Choir to lead choir classes for sixth-, seventh-, and eighth-grade students. Seventy students have chosen to participate. We are hopeful that grants will be secured in the future.

THE LANGUAGE ARTS AND THE FINE ARTS IN MY CLASSROOM

I teach the English language arts, including reading and writing, within a block schedule to all 85 eighth-grade students in three separate sections. In this article, I describe some of the ways I have shaped my instruction in the language arts to integrate the fine arts. I begin by describing a project that continues to inspire my efforts.

In April 2014, I proudly announced that five of my students had placed in the Chicago Haiku Festival contest, in which over 3,000 submissions were received. I joined these students and their parents for a ceremony at the Harold Washington Library on a brisk Saturday morning to honor their writing and the public recognition of their accomplishment. The students’ poems now hang in the school’s hallway outside the office, draped with origami cranes they folded and nestled among *sumi-e* brushstrokes of bamboo we painted together. When I walk into the building every day, I look at this display and remind myself why I enjoy teaching the language arts and, more importantly, why I prefer to teach more than just standards-based reading and writing in the era of *Common Core* standards, multiple standardized tests, and high-stakes teacher evaluations. I strive to ignite a dedication of and appreciation of the world students see around them and find ways to contribute to learning the arts and humanities.

Although our school has a “strong” fine arts curriculum to meet the needs of students, as an educator who was raised in a rich context of the arts I know they deserve more than our school is currently able to provide. I know the arts can offer students multiple ways to make meaning and engage with their world and can often be a source of discovery, as well as a way for students to develop their own identities through various media. I have never known life without the arts and cannot imagine teaching the language arts

without integrating the fine arts, even though I have no formal preparation as an arts educator. My priority is to address and teach the language arts standards, and I believe that to do so in good faith is to teach a well versed understanding of how to “read” and write various texts, whether the text is in the form of a painting, a song, a play, or a novella.

My teaching has been informed by many opportunities, including experience in schools within the district that have developed strong connections and partnerships with one of the many fine arts organizations in our city: the Joffrey Ballet, Chicago Lyric Opera, and the Chicago Symphony Orchestra, to name a few. Each of these organizations has a school-based outreach program and a robust curriculum that engages students in the arts, and they are a regular part of our school’s mission and vision to educate the whole child. These experiences have increased my awareness of how critical it is to make an effort to incorporate the fine arts into my language arts instruction, and they have acquainted me with resources I continue to call upon. I have also learned to capitalize on the spontaneous opportunities that arise in the classroom on a day-to-day basis.

Making the Most of Unplanned Opportunities

The study of poetry, a venerable art form, is particularly rich in planned and unplanned opportunities for teaching and learning. When we study poetry, I routinely dedicate time to performance poetry and teach ways to “read” and analyze the related visual arts. Students relish the opportunity to engage in meaning-making in new ways and to see how they can represent and understand their world better by expanding their understanding of how art can define and shape the human experience. When I provide opportunities for students to engage in a non-traditional manner, their learning becomes contagious in nature, and I learn more about them.

Film offers another learning opportunity for both students and teachers. *Louder Than a Bomb* is a documentary film, released in 2011, that follows Chicago high school students as they prepare for the world’s largest youth poetry slam, demonstrating the power of words to transform the self, others, and the world at large. The first time I show the film, I spend considerable time afterwards answering questions and allowing space for students to share a range of emotions. When I showed the film last year, my students were amazed to learn that I was present at the final slam competition shown in the film as an audience member, and even more surprised when I invited them to join me to view the upcoming LTAB finals. Three students accepted the invitation, and we went to the Cadillac Palace Theater in the spring to witness the stunning performance poetry of students only a couple of years older than they. Jocelyn’s thoughts on attending this performance capture the impact the experience had on her at the time.

I went to LTAB not because I had to, but because I wanted to. Learning about the history of this poetry competition and the type of people who entered it made it even more appealing. I’m glad I learned about this because without you telling us all about it, I wouldn’t be going this year to watch the performances again.

These moments matter and can never be thought of as too small to make a difference in student learning.

Inspired by Eleanor Coerr's book *Sadako and the Thousand Paper Cranes* (1977), I join a poignant story with experience in creating Asian art forms in a World War II literature unit that has become an annual staple in my curriculum because of what I have learned from watching students engage in the art of paper folding. When students struggle to learn how to create the crisp origami folds, they do not stop asking their peers for assistance until they get it right and can admire their handiwork hanging on our chain of cranes. They understand the powerful symbolism behind the artwork and are excited to send the cranes to Hiroshima, Japan, to be part of a worldwide statement of peace during the August Peace Day ceremony.

Each year when former students return to visit, many ask if I have started folding cranes with my current students, even if it is only three weeks into the school year. One former student, Thomas, was so taken by the idea of folding the thousand cranes that he began to fold his own thousand, each roughly half an inch in size. He came to class each day displaying his progress in a clear glass jar he kept tucked in his backpack. Thomas recently reflected on the experience, saying,

When reading Sadako and the Thousand Paper Cranes with Ms. Barilla it helped me understand the determination of Sadako, as our class decided to make a thousand in total I began the Herculean task of folding a thousand alone. I was inspired by Sadako much more from folding than I was the first time reading this story.

I knew Thomas was moved when he chose to fold his own thousand cranes, but he did not realize at the time that I was in as much awe of him determinedly making the meticulous folds in such tiny paper. I have come to know that people beyond the students in my class are also affected by these opportunities. I may be the only public school teacher who has ever been surprised by an office clerk with a back-to-school gift of origami paper to continue the work she sees as having a meaningful effect on students.

Planning and Funding

I have become adept at writing grants to local agencies to secure funding for projects that I would not otherwise be able to afford to plan: for example, the origami project and a subsequent fellowship to visit Japan to attend the Peace Day ceremonies and learn the origin of haiku. The grants I have secured have had a dual effect, both supporting my desire to learn and enhancing our literacy curriculum.

The most recent local grant funded the purchase of Japanese brushes, rice paper, and ink so students could learn the traditional sumi-e brushstrokes and create imagery to accompany their *haiku*, *tanka*, and *renga* poetry. It was important to create the opportunity for students to enhance their appreciation of written texts by including a focus on the aesthetic qualities of the visual paintings. The project incorporated both artistic and written skills to heighten the students' value of and appreciation for the endeavor. While the proposal was my idea originally, the art teacher and I decided to work together

to draw upon the value of learning in a cross-curricular manner and capitalize on the teaching strengths of each specific discipline. Eight art class sessions were allocated to teach the painting techniques and allow students to create their paintings, and the poetry lessons were taught in the language arts block.

During this project, I painted alongside the students, choosing to use my preparatory period to attend the art classes. I was learning how to create the four basic brushstrokes known as the "Four Gentlemen": the bamboo brushstroke, the wild orchid brushstroke, the chrysanthemum brushstroke, and the plum branch brushstroke. My students watched as I made mistakes, pooling too much ink on the paper or simply creating something not worth allowing the time to dry. They also watched me surprise myself when I figured out how to paint a bird atop a branch of blossoms and proudly showed me their progress as we learned together. The Mandarin teacher joined us for four of the sessions. We all watched a tutorial video on the process for each brushstroke during the art classes. I referred to our paintings during our language arts classes each day, highlighting the poem and the visual representation. In the language arts classes, we pushed desks aside to sit on the floor, writing the collaborative renga poems line by line, guided by our peer-selected student "master poet" of the day. We revised for poetic language to match the artistry of haiku and tanka, rereading hundreds of examples by ancient and modern poets. Students created their own bound book of poems and paintings for this unit, proud to have a project of their own to take home. We collaborated to create one book of poems and paintings meant specifically for Sadako's brother, Masahiro Sasaki. I had been able to communicate with Masahiro previously through my personal connection with Clifton Daniel, the grandson of former United States President Harry S. Truman. Clifton presented the cranes folded by my students to Masahiro in Japan, as both men are dedicated to promoting the legacy of peace.

Former students recently reflected on this experience, and their comments suggest the impact such planning and determination can have on learning. Justin commented, *"When many hands-on activities are woven into the lessons we are learning, the topic or lesson we are learning becomes clearer. We can grasp the concept more in our minds and analyze and critically think about it."* Justin also noted the ability of art to provide for self-expression. He added, *"Plus, the art-based activities can give us a chance to express our thoughts and feelings in a form of art, such as sumi-e painting and folding paper cranes."* Ben captured the various modalities students can use to explore and demonstrate their learning: *"I honestly loved the art-based things we did in class. I'm a visual learner and this helped me a lot."*

I am never guaranteed a grant proposal will be funded, but if I do not try, I cannot be true to what I believe my students deserve. I recently submitted a proposal for funding to have chapbooks of poems professionally printed, and I am more than happy to wait for the response, whatever it may be.

As I learned while teaching at another school previous to my current assignment, Chicago is rich in resources. Recently, I attended a summer workshop at the Chicago Foundation for

Architecture that was sponsored by the National Endowment for the Humanities and learned how to plan lessons on the physical and aesthetic nature of architecture within the context of teaching the language arts. The result was a lesson I taught in May, my favorite of the year. The students sat outside our elementary school building and visually examined the building's structure through a "reading a building" exercise. This was the first time many of them looked at the facade and overall construction of the school in any detail, even though most have come to this building since kindergarten. Among the comments as we "read" the building and discussed our observations together were: "I never noticed that before." and "What is that supposed to be?" We then wrote poems from the building's perspective and enjoyed the reflective nature of the whole experience.

Later that month, we went on a guided walking tour of downtown led by Chicago Architecture Foundation docents. Students were enthused to stop, look up at their surroundings, touch building facades, absorb the scale of Alexander Calder's *Flamingo* sculpture, admire mosaics in lobbies, and question and learn from the experience in a city that several of them had not had an opportunity to explore in this manner. We returned to school, immersed ourselves in Carl Sandburg's poems of the city we too admired, and listened to Studs Terkel's interviews with ordinary Chicago residents. Students began to gain a true appreciation of the immediate world around them and to realize they can add their own voices to this world. Kelly reflected on the experience, saying,

I have realized that literature and art is equivalent to one whole piece of the story. It all goes together. They have to be together in order for it to tell a complete story. The art lets the reader visually see it, and the words let the reader process the meaning behind it. Art will always be a part of literature.

I never explicitly thought of explaining in the way Kelly did, but through experiencing lessons that integrate the artistic world and the text, students can gain a more complete picture of a concept.

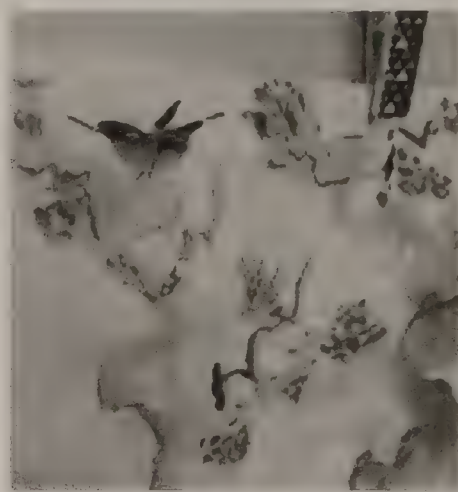
Taking Risks

I never refuse an opportunity to share what I believe about the arts, no matter the scope of the opportunity nor the risk involved. I recall a school staff talent show I was invited to join in which most of the content was traditionally slapstick and lighthearted comedy for the student audience. I used the opportunity to take a risk, selecting a piece of classical music, choreographing a three-minute ballet performance, and pushing my middle-aged body to capture my enthusiasm for this form of dance on the school stage. The audience was silent when I performed that day, shocked that they had no idea a former ballerina was among them, reading books and grading papers. I happily shared my dance background with students and answered the myriad of questions regarding pointe shoes and pirouettes. My colleagues teased me that I raised the bar for future talent shows, but students need to see the adults in their lives attend to the arts that shape who we are as people. This is why I have taught ballroom dancing classes during my middle school students' physical education classes and why I started

an after-school knitting club in a school that continues to offer academic-oriented after-school programming. I will continue to seek these opportunities and hope to continue to inspire my colleagues to join in the decision to provide all our students with a well-rounded education that includes the arts as an essential part of the curriculum.

FINAL THOUGHTS

Last spring, I was not able to rescue that piano by the school's dumpsters, but I continue to share my passion and enthusiasm for the arts in my teaching so my students will know how to interpret and contribute to their world. Perhaps one or more of these students will find ways to prevent pianos from being placed by dumpsters in the future because they will understand the value of the arts. They might even find ways to return a piano to each kindergarten classroom.



April 2014. My *sumi-e* painting created during our poetry and painting unit.

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A HIGH SCHOOL FOR THE ARTS

TINA BOYER BROWN

ABSTRACT

In this article, Tina Boyer Brown reflects on her experience as a founding teacher of a new contract public high school, The Chicago High School for the Arts (ChiArts®). She begins with an account of the school's creation as a place where the academic and the artistic join to offer a comprehensive, challenging education to prepare gifted young artists from diverse backgrounds for college, conservatory, and/or career. Ms. Boyer Brown describes the Arts Curriculum in detail and reports on the reflections of students who are nearing the completion of their education. The article closes with Ms. Boyer Brown's own reflections on the value of arts education. She concludes, "It is the effort of taking a set of practical skills and imbuing them with one's humanity that makes the practice of art so powerful for a student, a teacher, anyone" (p. 19).

INTRODUCTION

In the spring of 2009, I began my work with The Chicago High School for the Arts (ChiArts®), a new contract public secondary school where I am now the Creative Writing Department Head and part-time Arts Instructional Coach. To prepare for planning this new school, our small faculty traveled that spring to California to visit the Los Angeles County High School for the Arts and Orange County School of the Arts. While the faculty members were newly appointed, the board of directors, principal, and executive director had been in place for more than a year. In the summer following our trip, the academic faculty convened for the first time in meeting rooms at TAMS, a Chicago Public Schools teacher training facility across the street from U.S. Cellular Field, where the White Sox play. Our planning meetings and professional development occurred at TAMS because no building for the new school had been chosen and approved by the Chicago Public Schools. Since these initial meetings occurred in the summer, only theoretical students were in place at that point. While students had signed up to attend a brand new public arts high school, we had not yet met them.

I remember a community meeting held in the auditorium of Pershing West Middle School, a magnet school and our best possibility for a space that would in fact become ChiArts' first home. During this meeting, Houston, a dancer and a soon-to-be ChiArts freshman, stood at the mic and told us that the work, not the location, was most important. *"We'll dance in the parking lot if we have to."* Eventually, the colocation with Pershing West was approved.

That first move seemed less frenetic than future moves would be, but perhaps that sense of ease had more to do with our excitement in thinking about the work ahead. We were starting a school. That first working summer was full of foundation building, idealism, and articulation of a dream. Our fresh and excited

faculty and staff were generating the ideas upon which we would build a school. Once we were assigned the Pershing West facility, we began to meet there. I remember another day and a hot classroom where every faculty and staff member for our first year was wrestling with the concept of core values, which we ultimately identified as creativity, integrity, humility, perseverance, community, and balance. We chose these core values to support the mission and vision we had developed for the school and to give us a structure within which to teach and model effective habits for young artists.

THE MISSION

The mission of The Chicago High School for the Arts is to provide artistically gifted, diverse Chicago high school students intensive preprofessional training in the arts, combined with a comprehensive college-preparatory curriculum.

THE VISION

For Our Students

ChiArts' vision is to inspire and develop the artistic, academic, and leadership abilities of its diverse students. The high school will provide its students with the experiences and skills to help them reach their full potential as both artists and active citizens and instill in them a lifelong commitment to excellence and innovation in the arts as artists, educators, or civic leaders.

For Our School

The school will be an exemplary public high school, a model in providing a rigorous and exhilarating teaching and learning environment. ChiArts will be a leader in artistic and academic innovation and will collaborate with and provide access to the world-class artistic and intellectual resources of Chicago's arts and higher education institutions.

THE CORE CURRICULUM

The mission and vision of ChiArts guide decision-making throughout the entire program, which includes both the traditional academic subjects and a chosen art form. The scope and sequence of each subject area are designed to prepare students for college, conservatory, and/or career. One of the primary goals of the organization is to provide access to rigorous arts training for promising young people who might not otherwise have access.

The Academic Curriculum

Each day, from 8:00 AM to 12:00 PM, the focus is on academic subjects that include math, science, English, social science, world languages, physical education, health, computer education, and driver's education. Because this content is similar to that offered in most high schools, this article concentrates on the Arts Curriculum that is unique to ChiArts.

The Arts Curriculum

Key to focusing on our students and their artistic promise is the emphasis on arts learning as core content. Students spend one-third of their school day in arts training, and the expectations for this learning are both wide and deep. This emphasis and requirement are built into the foundations of the school, as its mission and vision place the arts at the center. The school was originally imagined/envisioned because of the lack of diversity of artists on the stages and in the orchestra pits in Chicago.

A similar emphasis is evident in the school's system of assessment and reporting. One measure built into the system is to include on the report card, all the arts classes a student has taken. Every year, only one of a student's arts classes is credit bearing, and the grades for these classes are included in the student's GPA. Since the arts program is not extracurricular, but rather an essential part of the curriculum, all students' arts classes and grades appear on their transcripts. The GPAs of ChiArts graduates are based on the same data as those of the students with whom they will compete for acceptance to college, university, or conservatory programs. The inclusion of arts courses and grades on students' transcripts allows future decision-makers a more complete sense of the applicant's academic and arts accomplishments.

The Schedule. The transition to the Arts Curriculum follows a lunch period from 12:00 PM to 1:45 PM when either study hall or an advisory period is scheduled. An Arts Break is provided until 2:00 PM when the arts classes (also called "conservatory") begin. This segment concludes with dismissal at 5:00 PM. The change of focus is evident during the Arts Break, fifteen minutes to prepare for the conservatory hours ahead. Other than lunchtime, it is the only unstructured time during the day, and different groups of students spend the break in different ways. Dancers change into leotards, and the young women put their hair into perfect buns. Instrumentalists take their instruments out of their dedicated lockers, tune them, and make sure they have sheet music and reeds, sticks, or mallets. Theatre students change into some combination of black, white, and gray clothing. Visual artists and creative writers "chill." For these students, the Arts Break brings a chance to talk, relax, get out any blocking social dramas, or forget their doubts, as the next three hours typically require quiet, concentration, focus, and attention to the image or the work.

The Conservatories. When the bell sounds at 2:00 PM, the conservatory portion of the day begins, and the bell does not sound again until dismissal. Each conservatory operates on a different schedule designed to provide the appropriate balance of classes, practice, and the study of context and technique. As has been noted, a key aspect of the arts programming is the amount of time students spend in class. Conservatory classes meet every day, and attendance is required. Intensive study allows for immersion in the work and gives teachers the time, over the course of each year and the entire four years, to help students develop both background and knowledge and to gain significant practice of their art. Students also reflect on the

current and past work done by artists in their chosen art and practice their own artistic form.

Each student auditions to be admitted to one of the five conservatories: Dance, Music, Theatre, Visual Arts, and Creative Writing. Students with any level of experience may apply and audition, including those who have little or no formal arts training and those who are novices.

Music and Theatre have two parts. Music students enter to study either Vocal or Instrumental Music. Theatre students enter to study either Acting or Musical Theatre.

In every art form, students study a range of content and gain a range of skills. Each conservatory's curriculum has a distinct scope and sequence. Within this larger structure, students follow a specified scope and sequence based on skill level, content major, or area of focus. Classes in every conservatory generally fall into the following groupings: background knowledge and context, technique, performance, and production. In background knowledge and context classes, students study the history, vocabulary, theory, concepts, major work, and artists related to their field. Some examples of background knowledge and context classes are:

Art History Studio I: Pre-History to Romanticism, Art History Studio II: Modern to Contemporary Music Theory Fundamentals, Music Theory I, AP Music Theory, Music History, Repertoire

Dance Language and Literature, Injury and Prevention

Theatre or Musical Theatre History and Literature

Background knowledge and context are integrated throughout the Creative Writing classes, and students also gain some of this information in their Literature classes during the academic portion of the day. All students take a Professional Development course, in which they learn about and prepare for the college application process, college or conservatory life and studies, and careers in the discipline.

Technique classes require students to focus on specific aspects of craft and practice that support the performance and production of their art form. Some examples of Technique classes are: Strings Technique I and II, Keyboard Skills, Voice and Speech, Physical Comedy, Responding to Art, Body Conditioning, and Pointe. The Performance and Production classes combine the study of technique with the creation of work. Most classes are Performance and Production classes, and the line sometimes blurs between them. Some examples of Performance and Production classes are: AP Drawing and Painting, AP Graphic Design, Choir, String Ensemble, Band, Acting I–IV, Ballet A–F, and Writer's Studio.

Dance. In the Dance Department, all students study the same forms of dance, and classes are differentiated by skill level. Students test into a skill-level class in ballet, pointe, modern, and Graham dance. Students may repeat a level as many times as necessary based on their skill development. Because pointe requires such specialized skill and physical strength, young women may be

required to take an additional year or years of physical conditioning in a class called Conditioning for Advanced Technique before being admitted into a pointe class. All dance students take academic-style classes about dance with their grade-level dance peers each year. The freshmen take Dance Literature and Language, in which they study dance vocabulary and read about dancers, choreographers, companies, and performances. In addition, all freshman dancers are required to take French to fulfill their first-year foreign language requirement. Sophomores study Dance Injury and Prevention. Juniors study Music for Dancers, and juniors and seniors take a class in Professional Development.

Music. In the Music Department, each student's scope and sequence is determined by the chosen major: voice, strings, winds and brass, percussion, piano, or guitar. All students must take Music Theory classes. First-year students test into either Music Theory Fundamentals or Music Theory I. Instrumentalists who focus on jazz take Jazz Theory in the sophomore or junior year. Students who wish to participate in one of the jazz combos must audition at the beginning of the school year. Students participate in large ensembles, chamber groups, and/or jazz combos. Each ensemble is both a class and an opportunity to collaborate and perform. Voice and non-piano instrumentalists all take a required keyboard skills class, and seniors take a course in music technology.

Theatre. In their initial applications to ChiArts, Theatre students audition to study either Musical Theatre or Acting. The curricula differ between the two programs, primarily in texts and types of technique classes. Musical Theatre students take dance and voice classes every year. Acting students take movement classes ranging from yoga, viewpoints, lacan, physical comedy, and stage combat to dance. Musical Theatre students study singing and keyboard skills. In both Acting and Musical Theatre, seniors create and perform a one-act play or musical.

Visual Art. In the Visual Art Department, all freshmen and sophomores follow the same scope and sequence. At the end of sophomore year, students request a major and support their request with a written statement, a critique of their work by all sophomore teachers, and a question and answer period during which the student explains the reasons for choosing the major. Students are then placed in a major based on their presentation, their work and artistic habits over the first two years of the program, and their statement. Visual Art students may major in photography, graphic design, mixed media, or painting/drawing. All Visual Art students take AP Studio Art in their major both junior and senior years. The courses are combined in junior and senior years. In AP Studio Art, the teacher differentiates instruction based on grade level and individual student needs. Juniors study technique and complete the breadth portion of the AP portfolio, and seniors focus on a self-identified concentration. Seniors' time in AP Studio Art is often self-directed, with the instructor acting as a facilitator for the completion of work in the concentration area. Juniors elect to take 3D Material Studies, Photomechanics, The Mural: History and Practice, or Typography.

Seniors take two electives from among the following choices: Contemporary Practices: Performance and Installation, Sequential Arts, Wearable Sculpture, and Digital Media.

Creative Writing. The newly implemented Creative Writing Program begins in the first year, when students write primarily poetry and fiction. In the second year, they will write primarily creative nonfiction and work for the stage and screen. Beginning in their third year, students will specialize in one of four areas: poetry, fiction, creative nonfiction, or dramatic writing. The students will produce a literary magazine, and their culminating project will be a book-length collection of work.

THE FACULTY

The current arts faculty is comprised of 70 to 80 teachers, eight accompanists, five department heads, four department assistants, two full-time arts faculty who also teach during the academic day, and a part-time instructional coach. To provide the required specificity of instruction in the variety of arts courses offered, conservatory faculty are adjunct faculty who teach as many as fifteen or as few as two or three hours a week. The adjunct faculty members offer many benefits, including the specialized knowledge required to support student skill development and growth in each area. Most importantly, adjunct faculty members have the time to make their own work, perform, choreograph, write, and stay active in their artistic communities. When the teacher works in the field and brings that daily experience into the classroom and the lives of the students, the teacher becomes a model of a way to live and work as an artist.

To be considered for a faculty position, candidates must have seven years of professional work in their artistic field and four years experience as an educator. Ideally, candidates will have high school teaching experience, but this is not required. ChiArts faculty members come from a variety of teaching backgrounds: teaching artist in a school, college, or university; teacher in a community arts program; or some combination of these roles. A few are certified, and a smaller number have taught full time in a public school.

Because many arts faculty members have not been public school teachers, significant mentoring and coaching is provided. Partially but not entirely, the reliance on adjunct faculty is a reflection of the state of arts education in Chicago and nationally. Our model is a choice that allows ChiArts to provide preprofessional training during which students learn from working artists and educators, evidence of the school's value for the working artist/educator.

THE VOICES OF OUR STUDENTS

For this article, I interviewed ten ChiArts upperclassmen about the effect their high school arts education has had on their lives, self-perception, and high school experience. I asked them to consider the following topics and to respond in conversation or in writing:

1. Describe your artistic practice and/or goals and how your artistic practice and/or goals have changed since you've been at ChiArts.

2. Select a conservatory teacher or teachers and describe the effect they and what they have taught has had on your artistic practice, your school experience, and/or your view of yourself.
3. In what way has your training in the arts affected your life both in and outside of the arts and/or your high school experience?
4. What effect has your training in the arts had on your plan or life after high school?

As their responses indicate, the students were enthusiastic about their education at ChiArts, and I admit that their answers were not very surprising to me. I already believe in the value of arts education. I was not surprised, either, when the students' responses revealed two dominant themes: the effects of the teachers with whom they worked, and the effects of ChiArts on their lives.

The Effects of Teachers

Students wrote and talked appreciatively about the importance of their teachers. When asked to describe the impact of a specific teacher, several of the students mentioned more than one. Three students cited freshman, novice, and first-year instructors. I suggest that there is something about the beginning of arts training that created a distinct impression, memories, and relationships for these students. Liz, a Visual Arts student, cited her freshman drawing, sculpture, and photography teachers as strong influences. She noted that the drawing teacher's lessons "still stick." *"He taught me how to see color and to lay out the values of an object. He also taught me to try new things."* From her sculpture teacher she learned *"about proportion and one must always look back at life."* Her photography teacher made her *"feel proud to be weird."* To a high school student, any non-conformity might be described as "weird," but a key part of an artist's development comes from an acceptance of oneself and one's point of view. Of the same freshman photography teacher, Oriana said that he *"has so far had the biggest impact on my artistic drive."*

Chrissy, a student who transferred from the Theatre to the Dance conservatory as a sophomore, spoke about her novice Body Conditioning teacher: *"I learned so much about my body and the bodies of others that has guided the growth and development of my dancing and has led to the development of interest in a totally different area."* These responses suggest that there is some lasting impact created by the introduction to a world where the students suspect they might belong. However, before they entered a learning community of artists, there had been no one to admit them. Deja, a Visual Arts student, said of her current Photomechanics teacher:

I feel the biggest thing that helps when educating about art or anything for that matter is community. Being actually cared for and listened to . . . While (our Photomechanics teacher) may be very far ahead in the field of photography, we learn together. She doesn't teach at us; she learns with us . . . Instead of this just being another classroom, this is our studio.

These comments also affirm that teaching the students, allowing them to audition and succeed, and providing an atmosphere in

which teachers and students find an artistic identity that is chosen, noticed, nurtured, cultivated, and valued has a positive effect on the culture and on the lives of teenagers who have models to emulate. Even a brief introduction to a new way of practicing an art form can have a positive effect. Reyna, a Dance student, provided an insightful summation as she described how her current Contemporary Dance teacher

has completely shifted the way I move inside the classroom in the few short weeks I've taken her class . . . She teaches us to constantly investigate and ask ourselves what more can we do in our dance and then translates what she teaches to everyday life.

The Effects on the Lives of Students

Adolescence is such a challenging time, especially when teenagers face the question of whether they should embrace an artistic identity. Three students noted their profound dependence on their self-identification as artists, in one case in the guise of a belief of dependence on the school. *"If I hadn't gone to high school here, I'd be dead,"* Liz said. Maurice wrote, *"Without [ChiArts/Arts training/the saxophone], I'd be nothing."* Within the context of our conversation, Oriana told me that she feels like she's going through a kind of mid-life or identity crisis because she is getting ready for college next year and will not major in an artistic discipline. She added, *"But that doesn't mean that I'll stop photographing or producing art. Art is very much a part of my identity . . ."* She knows who she is as a photographer, and her identity has been wrapped up in the study of and creation of beautiful pictures for four years. Now she will need to learn who she is as a student who does not study art.

While teenagers learn art-specific content and skills through their intensive training at ChiArts, they see the effects on their lives in a broader way. Christian said,

Art has taught me to be hard working. Everyone attempts to play music, so you must work extremely hard to stand out. Music is also a source of income. For me personally, music pays for everything I buy. In order to get work, you must be the best. In high school I have learned through experience that hard work brings you money.

Lulu, who plans to continue to study art after high school, wrote,

My training has gotten me into competitions and my work has been noticed. I have been able to do more research and become influenced by artists with similar works to my own. Inside I am always trying to expand my ideas and work.

Chrissy, who has experienced both the Theatre and Dance conservatories, wrote that she

always attribute(s) my compassion and empathy to my early exposure to theatre, but I think I've developed the most through dance. Theatre was a way for me to go into the minds and relate to people. However, dance has been my outlet and also my chance to explore other options.

She added, *"I learned the value and legitimacy of art and I can place my future in it, something I don't think I would have done . . ."*

without my training.” Maurice, the Music student, offered an eloquent conclusion:

Being trained in the arts allows me to connect to many different people. It allows me collaborate, network, understand how someone feels and to express to people how I feel. Being a musician taught me to listen, not just to the music, but to people too, which became a great foundation to learn to follow, it's ok to follow, because one need(s) to follow in order to lead. A leader is just an experience follower. Being a leader is shaping you to be a respectful and caring person. I was able to go from being a shy and quiet person to one with a passion, a goal, a dream, and a voice.

THE VOICE OF A TEACHER

Adolescents are artists, not because we give them art supplies and instruments, but because they are experiencing life’s fullness. Each of them has a voice and will find ways to express that voices with or without support. Art connects us all, and teenagers learn from us. The teacher can quash the artist and leave her forgotten by concentrating too much on memorization of insignificant information,

gathering and narrowing pathways of learning, and allowing adult voices to take precedence and exercise power. The study and practice of art-making in all its forms gives teenagers the tools to raise their voices by placing student voices in the center. If we are true to our primary mission that schools serve students, this is the place where their voices should be heard and their points of view welcomed, encouraged, and developed through practice.

Not all art forms nurture student voice in the same way, but the ineffable nature of artistry and the pursuit of such artistry encourages voice in a plié or a sonata as much as in a painting or poem. It is the effort of taking a set of practiced skills and imbuing them with one’s humanity that makes the practice of art so powerful for a student, a teacher, anyone.

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The Design and Use of Educative Curricular Supports for Text-Based Discussions in Science

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ABSTRACT

There are a number of challenges associated with using text in science to promote general literacy skills and advance conceptual understanding. This article identifies the principles that informed the design of educative curriculum supports for teaching such texts and reports how elementary teachers chose to use the supports, which included identified learning goals, discussion moves to support sensemaking with the text, and narratives of teachers' uses of text in science teaching. The within- and across-teacher variations are discussed in terms of their implications for student learning opportunities and the future design of educative supports for text-based discussions.

INTRODUCTION

Teaching science with the use of text can promote important general literacy skills while providing an opportunity for students to acquire specific academic language and relevant background knowledge that will advance the attainment of scientific concepts (Cervetti, Pearson, Bravo, & Barber, 2006; Romance & Vitale, 2012; Yore, Hand, & Florence, 2004). Furthermore, teaching students how to learn to read science text is consistent with both the *Common Core State Standards* (NGACBP & CCSSO, 2010), which call for students to engage in the "close reading" of text, and the *Next Generation Science Standards* (NGSS Lead States, 2013), which call for students to learn the language of science, as well as the ways in which ideas are communicated in the domain of science. However, there are a number of challenges associated with teaching science with the use of text. For example, teachers may be concerned that students will defer to the authority of text, rather than engage in their own sensemaking about scientific phenomena (Palincsar & Magnusson, 2001). In addition, science texts are often conceptually and linguistically dense (Fang, 2005, 2006). They include unfamiliar vocabulary (Cervetti, Kulikowich, & Bravo, 2015), and represent important ideas using graphics that may not be accessible to students (Slough, McTigue, Kim, & Jennings, 2010). In addition, students who have a history of comprehension problems may be poorly motivated to learn with text (Wigfield, Guthrie, Tonks, & Perencevich, 2004).

One approach to supporting students to learn from informational science text involves using text-based discussions. Discussion provides a forum for students to engage in the kind of thinking that supports text interpretation (Nystrand & Gamoran, 1991) and

reasoning with ideas presented in text (Jadallah et al., 2011). Discussion also provides students with opportunities to learn how to comprehend and learn from text (e.g., Beck, McKeown, Hamilton, & Kucan, 1997; Palincsar & Brown, 1984). Despite its promise, opportunities for students to engage in classroom discussions that are focused on high-level thinking about the ideas in text are quite limited (Applebee, Langer, Nystrand, & Gamoran, 2003).

The affordances of science texts, the challenges of learning from science text, and the potential of text-based discussions to mediate these challenges suggest an important role for developing educative supports that are designed to help teachers conduct text-based discussions with students. The purposes of this article are to: (1) describe and illustrate the principles that informed the design of these educative supports for teaching science with text, and (2) describe how teachers chose to use those supports.

We begin with a discussion of research on how teachers use curriculum materials and the theoretical perspectives that informed the design of the supports specific to teaching science with text. We then illustrate how that theory translated into the design of the supports. Subsequently, we report our findings regarding how teachers used the educative supports in their teaching. We conclude with a discussion of the implications of these findings.

RESEARCH AND THEORETICAL PERSPECTIVES INFORMING THE DESIGN OF EDUCATIVE CURRICULAR SUPPORTS FOR TEXT-BASED DISCUSSIONS

Research on Teachers' Use of Curriculum Materials

Given the widespread use of curriculum materials in elementary classrooms, the interaction between curriculum materials and teachers' practices can serve as a site for supporting teacher learning and facilitating change in practice, which could in turn create meaningful learning opportunities for all students (Ball & Cohen, 1996; Collopy, 2003; Davis & Krajcik, 2005; Grossman & Thompson, 2008). For example, Collopy (2003) and Remillard (2000) describe teacher learning and changes in practice that occur within the context of interacting with curriculum materials and their students. Although curriculum materials can play an important role in shaping teachers' thinking about instruction and the content (Arzi & White, 2004; Grossman & Thompson, 2008), how different teachers draw on and enact curriculum materials varies, resulting in diverse learning opportunities for students (Biggers, Forbes, & Zangori, 2013; Collopy, 2003; Schneider, Krajcik, & Blumenfeld, 2005). For example, Biggers and colleagues describe the diverse ways that elementary teachers use and adapt science curriculum

materials to support students in sensemaking. A variety of factors, including teacher knowledge, experience, and orientations, influences how teachers plan and instruct students using curriculum materials (Charalambous & Hill, 2012; Remillard, 2005; Roehrig, Kruse, & Kern, 2007). The context of the school and classroom also influences the choices teachers make in planning and enacting curricula (Lee & Buxton, 2008; Roehrig et al., 2007).

To support the interaction of teachers with curriculum materials, the use of educative curriculum materials, with explicit focus on teacher learning, as well as student learning, has been proposed (Ball & Cohen, 1996; Davis & Krajcik, 2005). Moreover, educative curriculum materials have shown promise in supporting teacher learning and practice (Cervetti et al., 2015; Lin, Lieu, Chen, Huang, & Chang, 2012; Schneider & Krajcik, 2002). Certain features, or characteristics, of curriculum materials might serve different purposes in supporting teacher learning (Beyer & Davis, 2009; Davis & Krajcik, 2005; Stylianides, 2007). For example, Beyer and Davis contrasted preservice elementary teachers' use of two types of educative supports in lesson planning: (1) lesson-specific narratives describing how a teacher taught a lesson, and (2) general expository supports about principles of teaching practice. The teachers used the narratives to identify specific adaptations to make to their lessons, whereas they drew on the general expository supports to identify principles to analyze the lesson plan.

Drawing on Remillard's (2005) framework, we view teachers' work with curriculum materials as a participatory relationship in which the resources of the teacher and the resources of curriculum materials interact to support the design and enactment of a lesson. This framework recognizes the resources, stances, and perspectives the teacher brings to the participatory relationship, such as orientations to the curriculum, pedagogical content knowledge, and knowledge of their students (Abell, 2007; Brown, 2009; Carney & Indrisano, 2013; Remillard & Bryans, 2004; Shulman, 1986). The curriculum materials have certain resources that also influence this relationship (Remillard, 2005). For example, the voice used in the text, types of particular features, or amount of support provided may factor into how teachers choose to use the materials (Beyer & Davis, 2009; Enfield, Smith, & Grueber, 2008; Herbel-Eisenmann, 2007; Lee & Buxton, 2008). This teacher-curriculum relationship offers a place for teacher learning while engaging with the text, designing a planned curriculum with the text, and enacting the curriculum within a particular context (Remillard, 2005). We drew on this empirical research and theoretical understanding of teachers' use of curriculum materials in designing the educative curriculum supports. We next describe the theoretical perspectives specific to text-based discussions that also informed this design work.

Theoretical Perspectives

Kintsch's (1998) construction-integration model of text comprehension provides one of the most comprehensive and explicit theories of language comprehension. As the name suggests, there are two processes that are essential to comprehension: *construction* and *integration*. As we read, we use the information in a text to

construct—or build—the meaning of text ideas. In addition, we integrate these newly constructed ideas with our existing ideas regarding the topic. The product of this meaning construction is called a *mental representation* of the text. The building of this mental representation begins with understanding the words, phrases, and sentences in the text; the reader must then integrate information in paragraphs, as well as across paragraphs and larger segments of the text. This integration results in new learning or elaborated knowledge upon which readers can draw in other contexts, whether reading-related or not.

Kintsch (1998) further elaborated that there are two possible mental representations of the text: the *textbase* and the *situation model*. The textbase refers to the representation that results from the immediate sensemaking of the words and phrases, while the situation model refers to the mental representation that results from the integration of the textbase with prior knowledge. This theory played a prominent role in the design of our supports for engaging with science texts. It guided our analysis of the texts that children were expected to read and supported our thinking about how the teacher might introduce the texts and focus the discussion of each text. For example, we identified vocabulary that might impede students' understanding of the textbase. We also illustrated how the text-based discussion could unfold to ensure that students were seeing the relationships among the ideas in the text and how these related to the ideas in the scientific investigations they were conducting. Our guiding assumption was that, if teachers did not treat the text-based discussions as an isolated activity within the unit but rather as an integral part of acquiring the knowledge necessary to successfully conduct investigations, the texts and investigation experiences would synergistically support the development of situation models specific to understanding ecosystems.

A useful extension of Kintsch's (1998) construction-integration model is the *landscape model* of reading (van den Broek, Young, Tzeng, & Linderholm, 1999). This model is designed to answer the question: "How do readers build a mental representation of the text as they read?" The landscape model is referred to as a computational model and was designed to capture both the *on-line processes*—that is, processes that are directly under the control of the reader during reading—and the *off-line* memory representation after reading. The landscape model represents reading as a cyclical process in which the ideas in the text fluctuate in their *activation*. There are three sources of activation: (1) the current cycle, that is, the interaction the reader is having with the text in the moment; (2) the preceding cycle, which is the memory representation of the text that has been constructed in the preceding cycles; and (3) background knowledge. With each of these cycles, the memory representation is updated and, in turn, influences the next activation. The authors adopted the term *landscape* in reference to the fact that, over the course of reading an entire text, ideas in the text fluctuate in their activation, creating a landscape of activations (van den Broek et al., 1999). The landscape consists of a series of peaks (active information) and valleys (information that is not the focus of active attention).

An important contribution of the landscape model is that it treats the reader's goals and judgments about text coherence as central to the reading process. *Coherence* refers to meaningful connections among the various sources of information that are available in the text. Coherence is the result of the reader organizing text information into a textbase or situation model. With each cycle, the reader makes judgments about whether the information that has been activated makes sense or whether additional activity will be necessary (e.g., rereading, consulting a graphic aid, or consulting an additional source). This perspective guided the design of the reading supports to the extent that we examined the texts for evidence of high- and low-coherence. When we identified places in the text that typified low-coherence (i.e., the reader would need to make a significant inference to understand the idea in the text), we developed questions or statements that the teacher could use to support the building of coherence.

Two types of coherence play a role in most cases of text comprehension: *referential* and *causal*. Referential coherence is attained when the reader clearly pairs the reference for the person, object, or event in the text with the person, object, or event being referred to: for example, when a referent such as "it" is correctly paired with "fish," the object being referred to in the text. Causal coherence, on the other hand, is attained when an event or situation is explained to the reader's satisfaction (e.g., the causes of acid rain).

Every reader has a particular threshold of coherence, which, in turn, influences the activity the reader engages in to comprehend the text. The threshold varies as a function of, for example, the purpose for reading, interest in the topic, and persistence in the face of reading challenges. If the threshold is met, the reader moves into the next cycle of on-line processing of the text; if the threshold is not met, then the processing in the current cycle continues. This means that coherence does not reside in the text alone but is a function of the interaction between the reader and the text. It is this interaction that makes the teaching of reading comprehension so demanding for teachers and speaks to the value of designing educative curriculum materials specific to teaching with text (Kucan & Palincsar, 2013).

The quest for coherence can help determine how teachers can support students' sensemaking with science text, which, in turn, should influence the design of reading supports for teachers. The discussion moves that teachers make when supporting their students' reading of science text should be guided by the goal of collectively building coherence so that each reader constructs both a textbase and a situation model of the text. With this theoretical backdrop, we turn now to how we designed the reading supports so that they were consistent with these theoretical perspectives on text comprehension.

THE DEVELOPMENT OF THE EDUCATIVE CURRICULUM MATERIALS FOR SUPPORTING TEACHERS OF ELEMENTARY SCIENCE UNITS

This research is part of a larger project that was designed to answer the question: "How might educative curriculum materials support change in teacher practice, teacher learning, and student learning of elementary science and literacy?" The project involved adding educative supports to an existing kit-based inquiry science unit on ecosystems. The kit-based curriculum that we chose for the project that is the focus of this article was *Science and Technology for Children* (STC) (National Science Resources Center, 2005). This curriculum is representative of kit-based science curricula and is one of the major kit-based curricula, the development of which has been supported by the National Science Foundation. We chose the specific unit (i.e., Ecosystems) guided by the state benchmarks for the upper-elementary grades.

In designing these supports, we drew on previous empirical research (e.g., Beyer & Davis, 2009; Cervetti et al., 2015) and our theoretical perspectives regarding student and teacher learning and text comprehension, as well as an analysis of the content and texts included in the curriculum materials. We also conducted case studies of teachers using the curriculum materials without educative supports, as well as a pilot study of teachers using the curriculum materials with supports. These studies guided the design and revision of the educative supports (Davis et al., 2014).

The educative curriculum materials were designed to support teachers in guiding their students to engage in investigation-based science using the STC materials. In the final version of the educative curriculum materials, we included a suite of supports to facilitate the teaching of science practices (e.g., conducting investigations, making observations), science content (e.g., the interdependence of living things), and reading and discussing the science texts that appeared in the Ecosystems unit. In the study we report here, we focused on the educative supports specific to the reading selections found within the unit.

AN OVERVIEW OF THE READING SUPPORTS IN THE CURRICULUM MATERIALS

In the Ecosystems unit of study (National Science Resources Center, 2005), the developer of the STC units included readings in a total of eight lessons. These readings complemented students' investigations of small-scale ecosystems (called "ecocolumns"), which were constructed using three stacked plastic soda bottles, with a top terrarium connected to an aquarium below. Table 1 provides an overview of the texts and the purposes they served. The texts were descriptive, informational texts designed to provide students with additional information regarding the construction and investigation of their ecocolumns. In each reading, there was a graphic, including, for example, drawings to show the parts of a fish, a graphic representation of photosynthesis, and a scale for interpreting pH readings. All the teachers chose to read the texts aloud to their students to ensure that the content of the readings

Table 1. Description of Readings in Relationship to Ecosystems Unit

Lesson	Title	Learning goals
3	Duckweed, Elodea, and Algae: Why are they important?	This reading informs the children about the algae and plants that they will be studying in their ecocolumns. It introduces the idea of producers/consumers and it introduces the processes of photosynthesis and respiration. It also describes some of the features of algae and plants that the students can observe in their sample.
4	Mosquito Fish: Strong little fish and Snails: A head at the end of a toe	<p>This reading informs the children about the fish that they are introducing into their aquaria. The children can read to learn:</p> <ul style="list-style-type: none"> • Why mosquito fish are a good choice to add to their aquaria; • About the characteristics of mosquito fish so that they can make careful observations (e.g., how to detect an adult from a young fish, how to detect the gender of their fish); • About how the mosquito fish interacts with the environment the children have set up in the aquaria. <p>This text can be used to help the students make close observations of the snails in their aquaria. The text is a good example of providing a description of structure/function relationships and how these relationships play out in a particular habitat. For example:</p> <ul style="list-style-type: none"> • The snail's soft body is protected by a shell • The snail gets around with the help of a part of its body that sticks out from the shell is made of muscle • This part also produces a film that makes it easier for the snail to move • It has a mouth part which, in fact, has teeth <p>In addition, the text is filled with facts about snails that can help children understand the unique characteristics of the snail that enable it to survive in its habitat. As the students read, they can keep an account of these facts.</p>
5	Growing plants: How seeds spring to life	<p>In Lesson 5, they learn about the plant life. Specifically, they will learn:</p> <ul style="list-style-type: none"> • The conditions plants need to survive and that they will have to provide in their terraria • Information about how the process of germination occurs • Structure/function relationships in plants
6	Isopods: More Like a Lobster Crickets: A Closer Look	<p>In this text, students learn:</p> <ul style="list-style-type: none"> • What animals isopods are related to • What molting is • Why animals molt • How to tell if an isopod has had its first molt and/or a recent molt • What an isopod needs in its habitat to survive • How the isopod contributes to its habitat <p>In this text, students learn:</p> <ul style="list-style-type: none"> • What class of animal crickets belong to • The structure of a cricket and the function these various structures serve • The difference between a young and adult cricket • The difference between a male and a female cricket • The role that a cricket plays in its habitat
8	The story behind acid rain and crops and cows: What's the problem?	The readings in Lesson 8 are designed to introduce the students to the pollutants that they will use in their investigations.
14	The Chesapeake Bay: An Ecosystem in Danger	The point of this introductory segment of text is to familiarize the students with the Chesapeake Bay and engage them in thinking about the Chesapeake Bay as another example of an ecosystem. One way to concretize this would be to ask the students to compare and contrast the ecosystems in their ecocolumns with the ecosystem of the Chesapeake Bay. You can provide the following categories to support the students: size, examples of animal life, examples of plant life, sources of pollution, and examples of interdependencies.

was addressed. The original STC materials included no guidance to the teacher regarding the use of the readings.

From our pilot studies of teachers using the texts in this unit, we found that teachers tended to focus students' attention on details rather than on the "big ideas" in the text (i.e., the situation model), they taught vocabulary in isolation, and they seldom used discussion to support students in integrating the ideas in the text with the investigations they were conducting. Finally, we saw few instances of teachers using the text to help students learn to interpret graphical information.

In response to these observations, for each reading, we developed a *learning goals* educative support designed principally for the purpose of identifying the situation model teachers should be building toward with the discussion of the reading. (The learning goals are identified in Table 1.) The most significant educative

support for reading the text was the *interactive reading guide*, which was designed to support the teacher to help the students interpret the textbase and build toward the situation model. In addition, where appropriate, we suggested how teachers might help students to interpret and use information that was presented via *graphics* (e.g., a graphic depicting the pH scale). Finally, we developed three *teacher narratives* describing a fictional teacher's decision-making related to using a specific text in a specific lesson. For example, one of the narratives depicted a teacher using a jigsaw approach (Aronson, 1978) to distributing the readings across groups (in a particularly reading-heavy lesson). In addition, in this vignette, the teacher provided the students a graphic organizer to report their findings from the reading to the class. Definitions and examples of each type of educative support are presented in Table 2.

Table 2. Description of Reading Supports

Name of support type	Description of support type	Example
Learning goals educative support	A statement describing the overall conceptual focus of the reading.	"The readings in lessons 4, 5, and 6 are thematic in the sense that they provide an excellent opportunity for students to be introduced to structure/function relationships and how these support the role organisms fill in an ecosystem. They will also be introduced to the idea that, in nature, organisms have characteristics that help them to survive in their particular habitat."
Interactive reading guide educative support	<p>A meta-script that the teacher could draw upon to support their engaging in an interactive reading and discussion of the text. The meta-script was designed to support teachers to help students comprehend the textbase and construct situation models of the text.</p> <p>The interactive reading guide included suggestions for integrating the reading within the total unit</p>	<p>Example of word level support: "terra is the Latin word for 'earth.' If you have Spanish speakers in your class, 'tierra' is the Spanish word for earth."</p> <p>Example of support for comprehending a paragraph of text: "In this paragraph, the author makes a claim that mosquito fish are strong little fish. What evidence does the author provide to support this claim?"</p> <p>Example of support for building a situation model of the text: "The next segment of the text is ideal for talking with students about structure/function relationships—a key cross-cutting theme in the life sciences. As you read each characteristic, stop and talk about how that characteristic, or structure, is helpful to mosquito fish and ideal for the context in which the fish lives."</p> <p>"This is an excellent time to look at the figure following the text that illustrates the differences among the male, female, and fry. Using pair-share, ask the students to find as many differences as they can among the three fish that are illustrated. Debrief with the class. The students can then be prompted to notice what type of fish they have in their aquaria and to draw their fish accordingly."</p>
Graphic aids educative support	Additional graphics to support teacher and student understanding of the text	Concept map for showing the cause-effect relationship of the pollution caused by salt.
Narrative educative support	A description of how a fictional teacher (based on composites of teacher choices) decided to support students during the reading discussion and his rationale for the choices.	"Mr. Coulter recognized that the readings from this lesson were particularly important for preparing his students to study the effects of adding pollutants to their ecocolumns and measuring and interpreting the pH scale so he wanted to be sure that the readings received full attention. However, he was also concerned about how much reading there was. So, he decided that, using the guiding questions, he would lead a whole-class discussion of the text, <i>The Story behind Acid Rain</i> , which, in addition to introducing the term "pollutant," provides information about the pH Scale. He then divided the class into two halves and assigned one half of the class the reading, <i>Cows and Crops</i> , which discusses the role and effects of fertilizers in our environment. He assigned the other half of the class the reading, <i>When Salt isn't Safe</i>"

Table 3. Self-Reported Characteristics of the Teachers

	Mr. Decker	Ms. Rosser	Ms. Jay
Years Teaching (total)	18	13	19
Gender	Male	Female	Female
Years at School	18	0	19
Grades Taught	4, 6	3–5	3, 4
Years teaching grade 4	15	1	17
Subject Most Enjoy	All but engineering	Earth science	All science, math, social studies
Degree Held	MA/MS	MA/MS	MA/MS
Class make up	4th	4th	4th

Consistently, our decisions about the design of the supports were guided by the reading comprehension theory discussed earlier. That is, we analyzed the texts to identify the conceptual goals and designed the interactive guides to support the teacher in helping the students to bring coherence to the text. We identified the text features that were likely to challenge students so teachers would focus attention on those. We were guided by the goal of supporting the integration of the text with the investigative activity in which the children were engaged. For example, we encouraged, in the guide, making connections between the information the students were encountering in the text with the ideas the children were discussing as they set up, stocked, and observed what was happening in their ecocolumns.

The interactive reading guide (a sample of which is included in Appendix A) was presented in two columns: the first column included the text, and the second column included the “ideas to support reading and discussion” that corresponded with each text excerpt.

In the next section, we describe how we studied teachers’ enactment of the readings and the extent to which they drew upon the ideas in the educative supports for text-based discussions.

METHODS

This study used a qualitative case study approach (Miles & Huberman, 1994; Stake, 2000) to consider the teachers’ use of the educative curricular supports for text-based science discussions (educative curricular supports) in three fourth-grade elementary classrooms during the enactment of an Ecosystems unit. These case studies were part of a large-scale, quasi-experimental study to test the effects of the enhanced educative curriculum materials on teacher learning, teacher practice, and student learning. By *enhanced*, we mean the original curriculum materials with the added

educative curricular supports. We purposefully selected these case study teachers from the larger study to look at the diversity of experiences that teachers might have with the educative supports for text-based discussions.

Participants and Context

The participants included three upper-elementary teachers and their students from urban-fringe school districts in a Midwestern state: Mr. Decker, Ms. Rosser, and Ms. Jay (all names are pseudonyms). All the teachers had a standard K–8 teaching certificate. Table 3 describes the characteristics of the teachers as self-reported on an initial survey. Table 4 describes the characteristics of students in their classrooms and schools.

The teachers participated in professional development to facilitate their teaching of the STC ecosystems unit. During these sessions, we introduced the reading supports, beginning with a discussion of how teachers used text in their current science instruction and how they supported students to learn with those texts. We then provided an orientation to the supports, presenting the rationale for the various types of educative curricular supports and overviewing how the supports were embedded in each lesson that entailed a reading.

Data Sources

The main data sources were video records of the enactment of reading lessons within the classrooms and interviews with the teachers. For each teacher, we had video records of their reading approximately four selections from the curriculum with their whole class (see Table 5). We also had field notes for each of the lessons based on protocols we had developed to guide field observations of the text-based discussions. In this three-column protocol, the first column was dedicated to the text excerpt, the second to the interactive

Table 4. Characteristics of Students at the School and in the Classroom

	Mr. Decker's class at Midland	Ms. Rosser's class at Woodruff	Ms. Jay's class at Kennedy
Approximate Total Number of Students in School	290	250	490
% Free and Reduced Lunch Students in school	83	54	60
Number of students in the class	24	31	30
Number of English Learners in the class	1	5	5
Number of students with an IEP in the class	5	5	2
Reported Reading Level Range of Class	1st to 6th grade	1st to 6th grade	1st to 5th grade

Table 5. Data Sources for the Case Studies

	Mr. Decker	Ms. Rosser	Ms. Jay
Number of selections read in whole class format	4	3	4
Lessons of the Reading Selections	4, 8, and 14	4 and 6	4 and 8
Number of Interviews during unit	2	2	2

reading guide for text-based discussions, and the third to noting what transpired between the teacher and students. Semi-structured interviews were conducted with each teacher; questions focused on the teachers' use of the curriculum and support for science practices. Teacher logs, student work, teacher-created materials, and teacher surveys were used to triangulate the data.

Analysis

To characterize the teachers' enactment, video recordings were divided into two-minute segments drawing on Borko, Jacobs, Eiteljorg, and Pittman's (2008) discussion that this segment length enables the analysis of teaching practices. Using partial-interval time sampling, we marked each segment for the presence or absence of activity related to the reading selections. Then, we developed coding schemes based on Duncan and Frymier's (1967) idea of tracers to look for evidence of the educative features in the teachers' enactment. Similar to tracers used in medicine and other research fields, Duncan and Frymier conceptualized using tracers in education to provide evidence of how a concept or idea is being used and modified within the curriculum. To identify tracers for our study, we looked for particular language and teaching practices that were in the educative curricular supports (but not the original curriculum materials) and that might be seen in the teachers' enactment. The tracers would enable us to characterize how the teachers drew on the different educative supports within their teaching.

We developed four types of tracers based on the features within the educative supports: (1) learning goals educative support tracers, (2) interactive reading guide educative support tracers, (3) narrative educative support tracers, and (4) graphic aids educative support tracers. The learning goals educative support tracers matched the learning goals suggested by the educative curricular supports for text-based discussion in the lessons but not in the original curriculum materials. For example, the learning goals educative support in Lesson 4 suggested that the selections might support children to learn "about the characteristics of mosquito fish so that they can make careful observations." A tracer might be applied when the teacher discussed with students how they can make additional observations based on their reading. The interactive reading guide educative support tracers matched the suggestions offered in the guides, identifying places where the teachers asked the questions or used discussion moves suggested in the guides. Narrative educative support tracers considered the teachers' use of the teaching moves suggested in the vignettes about Mr. Coulter, the fictional teacher in the narratives. The graphic aids educative support tracers matched the additional graphics provided by these educative curricular supports. Table 6 provides examples of each type of tracer.

To characterize the teachers' self-reported use of the educative curricular supports and their rationale, we coded the teacher interviews. First, we identified segments within the interview in

Table 6. Examples of Tracers Used to Code Videorecords

Type of Tracer	Excerpt from Educative Feature	Examples of Tracer
Learning goals educative support	In Lesson 5, they learn about the plant life. Specifically, they will learn: <ul style="list-style-type: none"> The conditions plants need to survive and that they will have to provide in their terraria . . . Structure/function relationships in plants (Lesson 5 Preface) 	Lesson 5 Preface Tracer 1: Teacher discusses the conditions plants need to survive and that they will have to provide in their terraria. Lesson 5 Preface Tracer 3: Teacher discusses the structure/function relationships in plants.
Interactive reading guide educative support	"In this paragraph, the author makes a claim that mosquito fish are strong little fish. What evidence does the author provide to support this claim?" What are the reasons why the author says that mosquito fish are "strong little fish?" (Lesson 4 Guide)	Lesson 4 Guide Tracer 1: Teacher asks questions about what reason and evidence the author provides to support the claim that mosquito fish are strong little fish.
Narrative educative support	Mr. Coulter thought the readings from this lesson were particularly important for preparing his students to study the effects of adding pollutants to their ecocolumns and measuring and interpreting the pH scale. So, he [Mr. Coulter] decided that, using the guiding questions, he would lead a whole-class discussion of the text, The Story behind Acid Rain. (Lesson 8 Narrative)	Lesson 8 Narrative Tracer 2: Teacher leads a whole-class discussion and read aloud of the selection.
Graphic aids educative support	Concept Maps for showing the cause-effect relationship of the pollution caused by salt. (Lesson 8)	Lesson 8 Graphic Aid Tracer 1: Teacher shows and discusses the concept map from the educative feature.

which teachers discussed their use of the supports for text-based discussions. Then, we divided these segments into idea units, typically a question and response (Miles & Huberman, 1994). Using open coding, we created a coding scheme around themes found in the teachers' responses and used this scheme to code each idea unit. The coding scheme is described in Table 7.

We created a matrix to look for patterns in each teacher's use of the educative curricular supports, as evidenced by the tracers and the teachers' interviews, triangulating the data across data sources (Miles & Huberman, 1994). These matrices were used to develop case study descriptions of each teacher's use. We used the teacher surveys, student work, teacher-created materials, and teacher logs to further validate the claims (Merriam, 2009).

Findings

We present the findings by teacher, since the interplay of their use of the various educative curricular supports is a particularly interesting aspect of the findings. In addition, the interview data are useful for interpreting the frequency-of-use data. We begin with an overview of the frequency data. Table 8 describes the proportion of total tracers for each support for which we found evidence of use within the teachers' enactments. For example, Mr. Decker's enactment shows evidence of using one of the 10 possible tracers for the learning goals educative supports (yielding a proportion of .10) as compared to 29 out of the possible 47 possible tracers for the interactive reading guide supports (or a proportion of .61). This would suggest that Mr. Decker drew more regularly on the interactive

Table 7. Coding Scheme for Teacher Interviews

Type of Code	Description of Type	Codes
Type of feature	Teacher describes use of a specific feature	Narrative about Mr. Coulter, preface, guides, reading selections, graphic aids
Frequency of use	Teacher describes how much they did used a feature	Used sometimes, did not use, high use
How/why useful	Teacher describes how or why they used the feature or how it might be useful	Useful for new teacher/substitute, to focus experience with text, to decide questions to ask student, provide useful information, has high experience with teaching text so does need support
How supported reading	Teacher describes how she/he supported the students with the reading selections	Provide overview to students, ask questions during reading, provide graphic aid, read as a whole class, use heterogeneous groups, provide additional time
Student success/difficulty	Teacher describes student success or difficulty with the reading selections	Difficulty with high level of text, success with learning vocabulary

Table 8. Proportion of Total Tracers for the Educative Supports Seen in the Enactment

	Tracers for Learning Goals Educative Support	Tracers for Reading Guide Educative Support	Tracers for Narrative Educative Support
Ms. Jay	.38 (3 out of 8—all of which are related to observations)	.04 (2 out of 43)	Enacts one of the moves suggested by the narrative—a focus on observations
Ms. Rosser	.71 (12 out of 17)	.21 (4 out of 19)	None seen
Mr. Decker	.10 (1 out of 10)	.61 (29 out of 47)	Enacts two of the moves suggested in narratives—provides additional graphic for students to make sense of pollution and uses a Venn diagram to compare animals.
(Note: Total number of tracers vary due to the different reading selections read as a whole class.)			

reading guide support than on the learning goals support. As Table 8 suggests, there was considerable variation across the three teachers, as well as variation within the practices of the three teachers. For example, while Ms. Rosser appeared to make extensive use of the information in the learning goals educative support (.71), she used few of the interactive reading guide supports (.21), and there is no evidence that her teaching was influenced by the narratives. In contrast, Mr. Decker made minimal use of the learning goals educative support, while there is evidence that he drew frequently from the interactive reading guide and made use of the narrative. Ms. Jay was the least influenced by the interactive reading guide. We begin our report of the cases with Ms. Jay.

Ms. Jay. This teacher made modest use of each of the educative curricular supports, appearing to be most influenced by the learning goals that were identified in the learning goals educative supports. As she introduced her class to the reading regarding the organisms they would be introducing to their aquaria and terraria, she told them that they would be able to “*make better observations after our reading.*” She consistently pointed out information in the text that would support their observations (e.g., the difference between male and female fish and the level of detail provided in the illustration of the fish). Using the information in the text to support making careful observations was one of the goals identified in the learning goals educative support.

On the other hand, Ms. Jay made virtually no use of the supports that were included in the interactive reading guide and was never observed teaching with the guide at hand. Why does this matter? What we see in Ms. Jay’s use of the text is a lot of focus on the textbase (the immediate words and phrases in the text) and very little focus on the situation model that the text supports. For example, there is no discussion of structure/function relationships (i.e., the composition and arrangement of the parts of a living organism support the organism in performing the functions that are required to survive in its habitat), nor is there any discussion of the relationship between the model ecosystem the students are constructing and the information in the text (e.g., why it is important to add scavengers to their ecocolumns). Ms. Jay drew from a repertoire of practices she had already developed when teaching

with informational text; for example, she had the students preview the text (title, headings, captions), and she occasionally asked the students to self-report their level of understanding (i.e., “*thumbs up, thumbs down . . . show me your understanding*”).

When asked about the use of the guide, Ms. Jay noted that she has taught reading for many years and did not need support to teach with text: “*Twenty years of teaching I can pretty much see what the kids need and what they don’t need and what they’re going to get stuck on and what they’re not going to get stuck on so to me to read off of a script . . .* (voice trails off).” When asked if there were other forms of support that would have been helpful for using the readings, Ms. Jay indicated: “*They would be really helpful if I were a first or second year teacher.*”

Ms. Rosser. The evidence suggests that Ms. Rosser was very attentive to the learning goals educative support. Of the 17 ideas that appeared in that feature across the three selections for which we have data, Ms. Rosser used 71% of them in her enactment. She used this support in a very explicit way: that is, after the students had read the selections with her, she consistently posted on an interactive whiteboard a series of questions that corresponded to two of those identified in the learning goals educative support. We illustrate this finding in Figure 1 and Figure 2 by presenting the learning goals educative support that appeared for Lesson 5 and the corresponding questions that Ms. Rosser posted for the students.

Following the reading with the class, Ms. Rosser posted the following questions on her board: (1) “What are some conditions plants need to survive?” and (2) “How will you provide these conditions in your terrarium?” (R_Lesson5_Slides). These questions align with the learning goal educative support in Lesson 4 that states “[students] will learn that the conditions plants need to survive and that they will have to provide in their terraria.” While Ms. Rosser drew on the learning goals for her questions, she did not ask any questions regarding structure/function relationships in plants, although this was clearly identified as a learning goal specific to this lesson.

With respect to the interactive reading guide educative support, Ms. Rosser made selective use of some of the items; we saw evidence that 21% of her elicitations matched those suggested by this support. Recall that the interactive reading guide educative

Figure 1. Preface from Lesson 4 of the Ecosystem Reading Supports. This shows educative support with the points that Ms. Rosser used to develop questions for her class discussion.

Preface

In the reading associated with Lesson 4, the students learned about structure/function relationships in the animal life that they will observe in their ecocolumns. In Lesson 5, they learn about the plant life. Specifically, they will learn:

- The conditions plants need to survive and that they will have to provide in their terraria
- Information about how the process of germination occurs
- Structure/function relationships in plants

Figure 2. Slide from Ms. Rosser's Lesson 4. This slide shows how Ms. Rosser drew on the Preface in the educative supports to develop questions for the text-based discussion.

Follow Up Questions:

"Growing Plants: How Seeds Spring to Life"

1. What are some conditions plants need to survive?
2. How will you provide these conditions in your terrarium?
3. Explain the process of germination...

support included: (a) specific questions, (b) ideas for invitations to students, and (c) information with which teachers could seed the conversation. Ms. Rosser drew from each of these; for example, she asked: "Why does the author tell us to 'sprinkle it [water] gently' when the surface is dry?" This is a question explicitly suggested by the interactive reading guide. She invited students to summarize orally the information presented in a diagram, which was also suggested by the guide. Finally, there is information in the guide that would help students to appreciate the considerable length that a cricket can jump, and Ms. Rosser shared that information with her students.

In studying excerpts of Ms. Rosser's teaching of the text, we noticed that, in contrast to Ms. Jay, who did not use the reading to pursue connections between the reading and the students' investigations, Ms. Rosser encouraged the students to use the information in the text to think about the investigation they were conducting with their ecocolumns. For example, after reading about the conditions that plants need to survive, Ms. Rosser asked the students to identify how they are providing these conditions for the plants in the terrarium (i.e., light, appropriate temperature, and water).

In contrast to Ms. Jay, Ms. Rosser was much more positive about the educative curricular supports, noting in her interview that she liked the readings and the supports and found them all to be informative. She indicated that the questions and prompts in the reading guide educative supports "went along well" with the readings

and gave her children important things "to think about and try to answer." She believed that their value was in focusing attention and helping students to focus on what should be learned in each of the readings. While we saw evidence that Ms. Rosser's exchanges with her students reflected 21% of the ideas in the reading guide educative supports, Ms. Rosser indicated that she believed that she used 70% to 75% of the ideas in the supports. It is, of course, possible that a teacher could be more influenced by the educative curricular supports than is captured by the use of tracers.

Mr. Decker. Representing our most complicated case, Mr. Decker presents a somewhat different profile from the other two case study teachers. He made minimal use of the learning goals educative supports (only 10% of the ideas reflected in the supports are captured in his talk with the students), but he made the greatest use of the interactive reading guide educative support; in fact, his comments and elicitations can be traced to 61% of the suggestions in the reading guide educative supports. Finally, he made the most use of the ideas suggested in the narrative educative supports, using two of the teacher moves depicted by the teacher portrayed in one of the narratives (both moves entailed the use of graphic organizers).

A close look, however, at the instruction that unfolded in Mr. Decker's class tells a mixed story. On the one hand, one of the most successful experiences his class had in the course of the Ecosystems unit occurred in the context of reading; on the other hand, there were a number of unproductive exchanges around the text. We begin with a story that shows some moderate success using the readings productively and in a manner consistent with the educative supports.

Three of the selections described the three forms of pollutants that the students would be adding to their ecocolumns. In each of these readings, the students learned about the pollutant, why it is considered a pollutant, and how the pollutant gets into the environment. Then, students were expected to create a poster and presentation to share their understanding of the pollutant that they would add to their ecosystem. In terms of our educative curricular supports, this lesson included a narrative and a reading guide educative support for a whole-class reading of each text and a graphic organizer to support student understanding of the cause and effect

relationships described within the readings. Although Mr. Decker did not make the same choices as the teacher in the narrative, he did draw on the reading guide educative support to discuss the reading as a whole class. Then, the class reviewed the graphic organizers provided in the supports. Next, students went off in their small groups, and used the reading and the graphic organizer to create posters to present to the rest of the class. Mr. Decker judged this activity successful to the extent that the posters and presentations captured important information about each of the pollutants, setting the children up well for their investigations. In addition, Mr. Decker commented on their “*excellent work*,” and, indeed, the observations showed the students to be highly engaged.

Other experiences with the readings were not as successful. There were numerous, frequent behavior issues that were constantly addressed: children not sitting in their seats, making noise at the pencil sharpener, eating and falling asleep, and seeming to come and go from the classroom. The consequence of these classroom management challenges was that sustained interactions with the students about ideas (in the text, or with respect to the investigation) were quite rare.

Looking more closely at the discussion, we noticed that Mr. Decker made unusual choices regarding question-asking. For example, one of the texts describes the many characteristics of the mosquito fish that make it ideal for living in a wide range of environments (e.g., its tolerance for a range of temperatures, its territorial nature, and the fact that the female has huge numbers of babies). For the portion of the text that describes the large numbers of babies that are borne by female mosquito fish, the interactive reading guide educative support suggests the following:

Children are likely to know that, in the animal kingdom, land animals typically have very few offspring at one time. The children can be encouraged to think about why it might be so different for fish. [The conversation should link to the likelihood of survival.]

Instead of asking the students “Why do you think the female has so many babies?” Mr. Decker asked, “*Why do you think the female **could** (emphasis ours) have so many babies?*” This question led children to discuss the relative size of the female—the fact that she is bigger than the male. Mr. Decker recognized that this was not the reason he was looking for and prompted further, “*think of survival*.” When no one replied, Mr. Decker elaborated, “*So, the babies can survive*,” leaving the students to infer that the larger the number of babies, the more likely that at least some will survive.

As another example, when reading a text that describes the decrease in the oyster population of the Chesapeake Bay, Mr. Decker—as suggested by the interactive reading guide educative support—did use the text as an opportunity to focus students’ attention on cause and effect; in fact, he pointed out to the students that it is not uncommon for informational text to be organized in terms of cause and effect. However, Mr. Decker sometimes confused cause and effect in this context and, when he was directing the students to identify the effect of an event, what he was actually

interested in eliciting were the causes. This made for awkward and unproductive exchanges.

In his interviews, Mr. Decker expressed his enthusiasm for both the readings and the supports for teaching with the readings. With respect to the readings, he commented, “*the readings are highly important*,” and he discussed the commitment he made to setting time aside for the reading and allowing time for the class to discuss the readings. He was appreciative of the educative supports associated with the readings, noting in his interview that:

I like this because I let them read and I just chime in with these things. Yeah. It just—nice to have a little question so you don’t have to make it up because invariably there’s gonna be someone that’s off topic . . . So these things really help. This is a nice addition to the curriculum.

Use of the Educative Supports in the Future

All three case study teachers described their plans to use the Eco-systems unit with the educative curricular supports in the future. In their interactions with the researchers, the teachers expressed confidence in their use of the supports, given the students they were teaching. For example, Ms. Rosser stated, “*I’ll definitely do all the reading and class discussions [in future years]*.” In his interviews, Mr. Decker described how he could use features of the educative curricular supports differently. For example, he commented, “*I suppose I could have used [the preface] as more of a guideline*.” Hearing the reflections on their teaching, the researchers chose not to comment further on how to use the supports within these particular contexts; however, the information from this study informs the future work in designing curriculum materials and intervention to support teachers to facilitate class-wide text-based discussions with science texts.

DISCUSSION

This study of the design and use of educative features that support teachers to use text effectively while teaching science underscores some of the affordances and challenges of this type of design work. Similar to other studies (e.g., Remillard, 2000; Schneider et al., 2005), we found variation in the teachers’ interactions with the curriculum materials, including the educative curricular supports for text-based discussions. Mr. Decker and Ms. Rosser drew regularly on particular educative supports, whereas Ms. Jay showed modest use of them. The teachers tended to use specific educative supports for particular purposes, as suggested in previous studies (Beyer & Davis, 2009; Stylianides, 2007). For example, Ms. Rosser described her use of the learning goals educative supports to focus the reading discussions, and Mr. Decker drew on the interactive reading guide educative supports for questions to ask his students while reading. Despite these differences in their use of the educative supports, all three teachers’ use of the supports seemed to help students develop a strong textbase that could focus their observations of their ecocolumns.

Although each teacher acknowledged the usefulness of the educative curricular supports in particular contexts, and noted

that their use of the supports helped students develop a textbase, the teachers' enactments did not typically lead to discussions that would support deep student learning around the topic of ecosystems as envisioned by the educative supports. That is, the teachers' enactments did not extend the students' understanding of the situation model, which meant that students were not as well supported to make connections to the scientific crosscutting concepts of the unit, such as structure/function relationships. Thus, this study has raised a number of issues we think worthy of additional consideration and research.

The first issue is the role of teacher knowledge in enacting text-based discussions and the design of educative curricular supports that attend to teacher knowledge. Teachers' use of discussion as a means of supporting students to build knowledge with text is influenced by the clarity and completeness of their own understanding of the content they are teaching (Kucan & Palincsar, 2011; Snow, Griffin, & Burns, 2007). Recognizing the role of content knowledge within the participatory relationship between the teacher and curriculum (Charalambous & Hill, 2012; Remillard, 2005), one hypothesis we are entertaining is that we could enhance the value of the educative curricular supports by attending more to the development of teachers' content knowledge. For example, in the learning goals educative support and throughout the interactive reading guide educative support, we continued to reconsider the value of using the crosscutting science concept of structure/function relationships to support the students to build a situation model of the respective texts (NGSS Lead States, 2013). None of our case study teachers made use of this concept in their teaching. Perhaps they needed a clearer rationale for why we felt this emphasis would be powerful with these texts; in addition, perhaps we should have elaborated—beyond the multiple examples in the text—to provide the teachers with a larger conceptual framework for considering structure/function relationships. Likewise, we designed the educative supports for the interactive reading with certain assumptions about the teachers' content knowledge; that is, we assumed that, having signaled the key scientific concepts and their relationships, teachers were positioned to mediate the discussion. However, our experience suggests that we might have productively provided more information to deepen the teachers' content knowledge. Including this type of rationale for and explication of the crosscutting concept or science content might facilitate the development of both teacher content knowledge and pedagogical content knowledge (Beyer, Delgado, Davis, & Krajcik, 2009; Davis & Krajcik, 2005; Lin et al., 2012; Schneider & Krajcik, 2002; Shulman, 1986) and support teachers in using the informational text more effectively to build students' situation models.

Teachers' beliefs about the nature of comprehension and the role of discussion in supporting the co-construction of meaning are likely to have played a role in the uptake of the educative curricular supports for text-based discussions, given other findings on the influence of teachers' beliefs and orientation in the use of and learning from curriculum materials (Collopy, 2003; Remillard,

2000; Remillard & Bryans, 2004; Schneider & Krajcik, 2002). Each of our case study teachers was an experienced educator who brought a well-established repertoire of teaching practices to their use of texts in the classroom. While we spent time in the professional development discussing teachers' current practices when teaching with science text, these practices received minimal attention. Perhaps more sustained attention to how interpreting and learning with science text is similar to and different from learning with other forms of texts (such as literary texts) would have created a better understanding of what we, the developers, were attempting to achieve. We might have drawn on examples of other forms of professional development that provide teachers the opportunity to experience and witness a particular type of teaching and learning, and to cooperatively analyze that teaching and learning in such activities as lesson study or analyzing video clips (Lewis, Perry, Friedkin, & Roth, 2012; Rosebery & Puttick, 1998; Sherin, 2004; Wilson & Berne, 1999). Similarly, we could have acknowledged the current approaches that teachers were using (e.g., Ms. Jay's general comprehension monitoring strategies) and contrasted them with the more conceptually-focused discussions we were attempting to foster.

The design of our educative curricular supports for text-based discussions also made particular assumptions about the culture of the classroom and the role the students assume in sensemaking. For example, a number of our questions and elicitations were open-ended and encouraged the students to share their own thinking about what the author was communicating, why the information was relevant, or what the strength of the evidence was for the claims that the author was making. Furthermore, the emphasis on discussion assumed that children were accustomed to listening to one another and making contributions to the discussion based upon their own sensemaking of the ideas in the text. We did not know enough about the histories of our classrooms to know whether this assumption was accurate with regard to the culture of these classrooms, but we do recognize the challenge of setting up such cultures and their relative infrequency in typical elementary schooling. Perhaps a useful addition to these supports would have been a statement about the epistemological assumptions inherent in the supports and the implications of enacting the ideas and practices communicated in the educative supports for the culture of the classroom (e.g., the roles of teachers and students in learning). This is consistent with the argument that Davis and Krajcik (2005) have made about including statements regarding the rationales guiding the design of educative curriculum materials.

These case studies raised questions about the nature of educative curricular supports for text-based discussions. The heart of these supports was the interactive reading guide. The learning goals educative supports were designed to provide an overall road map, while the suggestions in the reading guide educative supports were meant to support specific navigating of the texts. One of our teachers (Mr. Decker) reported that he did not read the learning goals educative supports, and while it was not our intention that the ideas in the guide be regarded as a "script," this

is how the guide was perceived by one of our teachers (Ms. Jay). These responses to the educative supports have led us to speculate whether we might have made more frequent and productive use of the narratives in the interest of supporting teachers to envision different ways of using the texts to support knowledge building, particularly given the power of narratives we have found in our other work (Arias, Bismack, Davis, & Palincsar, in review). For example, we might have launched the educative curricular supports with a narrative of a teacher who was committed to two goals: (1) using the readings to support his students' understanding of the core concept of structure/function relationships, and (2) using the readings to enrich the students' investigations of their ecocolumns. We could then have drawn upon this narrative with each reading, illustrating how the particular reading supported the teacher's goals and how the text was taught to enhance the likelihood that goals were met.

Thus, we did see limitations in how the teachers took up the educative curricular supports, particularly in terms of using the supports to help them foster the development of students' conceptual knowledge and building a situation model through making connections between the text and the investigations. The teachers did not engage in the kinds of text-based discussions intended by the educative supports—discussions that might have required a different kind of classroom culture than was established in their classrooms. That said, we also saw some important strengths in how the teachers used the educative curricular supports. Specifically, each of the three case study teachers, in different ways, used them to support their students' development of the textbase and used this developed textbase to support the students' investigations. This was evident in how Ms. Jay helped her students use details from the readings to support students' detailed observations of the organisms in their ecocolumns, how Ms. Rosser discussed plants' needs with her students, and how Mr. Decker engaged his students in considering cause and effect.

While this study included a small number of cases, we are appreciative of the chance to look closely at teachers' practices vis-à-vis the readings and educative curricular supports and are encouraged that this close study has provided grist for refining theory and practice regarding the design and use of educative curricular supports specific to teaching with challenging text. Furthermore, we appreciate the opportunity to have conducted this research in contexts where the majority of the students would not typically have experienced this type of ambitious teaching. We are intrigued by the possibilities that educative curricular supports offer teachers in differentiating instruction for students with diverse language and literacy profiles and engaging students in the "close reading" of informational text that is called for in the *Common Core State Standards* (NGACBP & CCSSO, 2010) in the context of the investigations called for in the *Next Generation Science Standards* (NGSS Lead States, 2013).

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Acknowledgements

This research is funded by the National Science Foundation through a REESE Award (grant number 1007753) to Elizabeth A. Davis, Annemarie Sullivan Palincsar, and P. Sean Smith. However, any opinions, findings,

and conclusions or recommendations expressed here are those of the authors. We appreciate the participation of the teachers and students with whom we worked, as well as our colleagues on the ELECTS project at the University of Michigan and at Horizon Research, Inc., including Sean Smith, Amber Schultz Bismack, Sylvie Kademian, Stefanie Iwashyna, Loren Marulis, Amanda Benedict-Chambers, and John-Carlos Marino. We presented an earlier version of this paper at the 2014 NARST Annual International Conference, Pittsburgh, PA.

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APPENDIX A

Sample educative supports for Lesson 4 Reading of the Ecosystems Unit. This includes the learning goals educative support and interactive reading guide educative support for the reading selection for the lesson.

LESSON 4
Reading

Mosquito Fish: Strong Little Fish and
Snails: A Head at the End of a Foot

Preface

The readings in lessons 4, 5, and 6 are thematic in the sense that they provide an excellent opportunity for students to be introduced to **structure/function relationships** and how these support the role organisms fill in an ecosystem. They will also be introduced to the idea that, in nature, **organisms have characteristics that help them to survive in their particular habitat.**

Mosquito Fish: Strong Little Fish

This reading informs the children about the fish that they are introducing into their aquaria. The children can read to learn:

- Why mosquito fish are a good choice to add to their aquaria;
- About the characteristics of mosquito fish so that they can make careful observations (e.g., how to detect an adult from a young fish, how to detect the gender of their fish);
- About how the mosquito fish interacts with the environment the children have set up in the aquaria.

Text	Ideas to support reading and discussion
For copyright purposes, we have covered text from the STC Curriculum Materials. This section includes the text for the student reading "Mosquito Fish: Strong Little Fish."	<p><i>In this paragraph, the author makes a claim that "mosquito fish are strong little fish." What evidence does the author provide to support this claim? What are the reasons why the author says that mosquito fish are "strong little fish." [they can tolerate many things in their environment (changes in temperature, changes in movement, changes in amount of water).</i></p> <p><i>"terra" is the Latin word for "earth" [If you have Spanish speakers in your class, "tierra" is the Spanish word for "earth."]</i></p> <p><i>So, here the author tells us another way that mosquito fish are strong. What new information did we learn? [They will fight to protect their territory]</i></p> <p><i>Why does the author say, "Remember this after the unit is over." [We will have to be</i></p>

	careful what environment we put our mosquito fish into.]
<p>For copyright purposes, we have covered text from the STC Curriculum Materials. This section includes the text for the student reading "Mosquito Fish: Strong Little Fish."</p>	<p><i>So, how did the mosquito fish get its name? [eating the mosquito larvae]</i></p> <p><i>What do we know about the mosquito fish that explains how it can survive in 70 different countries all over the world? [all the variations in the environment that it can survive]</i></p>
<p>For copyright purposes, we have covered text from the STC Curriculum Materials. This section includes the text for the student reading "Mosquito Fish: Strong Little Fish."</p>	<p>This is an excellent time to look at the figure following the text that illustrates the differences among the male, female and fry. Using pair-share, ask the students to find as many differences as they can among the three fish that are illustrated. Debrief with the class. The students can then be prompted to notice what type of fish they have in their aquaria and to draw their fish accordingly.</p> <p>This next segment of text is ideal for talking with students about structure/function relationships – a key cross-cutting theme in the life sciences. As you read each characteristic, stop and talk about how that characteristic, or structure, is helpful to the</p>

Whenever possible, it is helpful to bring the students' attention to large cross-cutting themes in the life sciences. Structure/function relationships is one example of a cross-cutting theme.

The Flying Man: The Power of Visual Media in Social Education

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ABSTRACT

The visual arts and media historically employed by teachers as a corollary to “traditional” social education can play a more vital role in promoting critical inquiry among students. The use of short films like *The Flying Man* (2013), a 2013 motion picture which depicts an almost mythic vigilante in a realistic world, can help educators highlight relevant contemporary issues and support an active, constructivist role for student critique. This article describes the role of visual media, the applications of visual art pedagogy, and the potential of works like *The Flying Man* to foster critical inquiry in a nontraditional manner.

INTRODUCTION

In May 2011, President Barack Obama appeared on national television and announced to the world that Osama bin Laden, the “leader of al-Qaeda and a terrorist who [was] responsible for the murder of thousands,” had been killed by U.S. soldiers (Phillips, 2011). During his short address, the president thanked the personnel involved in the operation and offered solace to the families of bin Laden’s victims. He also spoke of *justice* in a variety of ways, referring to the U.S. strategy toward terrorists, to bring them to justice, and to the accomplishment of an overarching goal in the battle against al-Qaeda, “Justice has been done.” Most notable was the president’s statement that this goal had been accomplished with bin Laden’s death. He concluded his remarks with a reminder of what America stands for: “liberty and justice for all” (Phillips, 2011).

The definition of justice is nebulous, particularly in reference to the war against terrorism. Few would argue that the operation conducted against Osama bin Laden by U.S. forces was not justified, but what of other actions: for example, the use of unmanned drones over other nations’ territories? Are weapons that can deliver missile strikes without warning explained by a clear legal rationale, or are they considered a remedy representative of justice (Abé, 2012; Byman & Wittes, 2013; Subbaraman, 2013)? In this article, I argue that the central value of social studies education is determined by the degree to which it offers an educational forum to explore these critical issues, in particular, the concept of justice—what it means, what it represents, and who is responsible for ensuring that justice is done.

In modern popular culture, justice has become the particular province of the superhero, and contemporary Americans are

fascinated by the archetype. It was Joseph Campbell’s seminal work on mythic figures, *The Hero with a Thousand Faces* (1972), that helped to popularize the modern concept of the *hero*, “a person called by extraordinary events to act in extraordinary ways” (Meyers, Holbrook, & May, 2009, p. 10). The current popularity of fictional characters like Superman, Batman, and the Avengers may seem like a contemporary phenomenon, but in truth, the depiction of heroes in American popular culture goes back to the nation’s birth. However, the heroism of these contemporary figures—their willingness to act, at a minimum, in an extralegal manner by doing what traditional law and order authorities cannot or will not do—is markedly different from the depiction of justice in *The Flying Man*, the film that is the focus of this article.

THE FLYING MAN: A SYNOPSIS

The Flying Man is a short film cowritten and directed by Marcus Alquieres, a filmmaker originally from Brazil and now based in Canada. The film focuses primarily on two characters: the eponymous figure of the Flying Man and Mike, a person who is engaged in a possibly criminal enterprise and fears the possibility of the Flying Man’s violent intervention. Released in 2013, *The Flying Man* was an online sensation, with over three million views on YouTube and expansion to a feature-length film on the horizon. (The film is available for viewing on both YouTube, <https://www.youtube.com/watch?v=Gj1MqHgFnmE>, and on Alquieres’ website, <http://www.malquieres.com/>). The topics raised by *The Flying Man*—vigilantism, justice, law, and social responsibility—are powerful, engaging issues for secondary students across a wide variety of subject areas.

Alquieres’ film, though only nine minutes in duration, manages to provoke intriguing questions about the role of law, the nature of good and evil, and the responsibilities of citizens in a functioning civil society. The film begins with a kaleidoscope of images, seemingly culled from news reports and bystander video, of a mysterious figure flying over an unnamed city. Police helicopters try to move closer, but the figure jets away, more quickly and nimbly than they can. In short order, it becomes clear that the Flying Man has an agenda, as he begins to seize people, seemingly at random, and execute them (see Figures 1 and 2).

An unseen reporter announces, “We believe that the flying man who is spreading panic in our city is some sort of flying vigilante, due to the fact that most of his victims have extensive criminal records . . . that can be a relief to the good citizens, and an alert to the outlaws. But the question remains—whose law is the ruthless vigilante applying?” (Alquieres, 2013).

Figure 1. Image from *The Flying Man* Depicting an Attack (Alqueres, 2013)

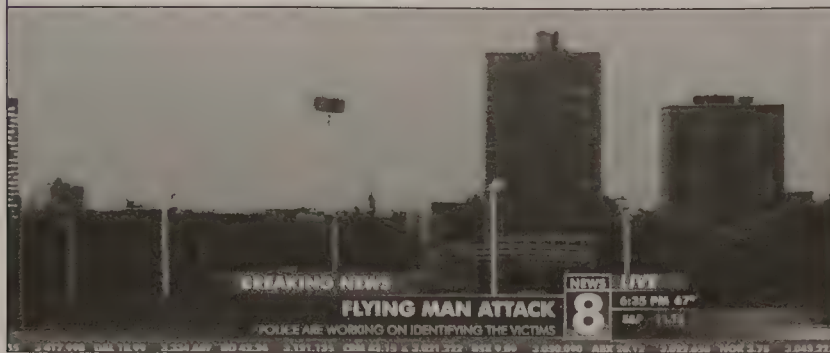


Figure 2. Image from *The Flying Man* Depicting the Victims (Alqueres, 2013)



At this juncture, the scene shifts to two men traveling by car at night. Mike, the driver, is clearly anxious and nerve-ridden, while the passenger, an older man named Rob, is unperturbed, reading the newspaper as the car moves toward an unexplained rendezvous. They stop at a drive-through restaurant and, while waiting for their order, Mike asks Rob about the enigmatic vigilante:

Mike: How do you think he knows? The flying guy. How do you think he knows who to choose, who deserves it?

Rob: You worry too much. He's only one guy, he can't catch everyone . . . the media is blowing this way out of proportion. He's already got, what, five guys . . . ?

Mike: 35. (Alqueres, 2013)

After stopping at the restaurant, Mike and Rob drive to a shadowy side street, where they are due to meet someone. While the film never directly implicates the two in a criminal enterprise, there are subtle hints: for instance, after reaching the rendezvous point, Rob exits the vehicle briefly and retrieves a handgun from the trunk, further unnerving Mike. There is, however, a simultaneous degree of haziness about the level of severity of the whole enterprise. At one point, Rob tries to calm Mike's anxiety: "We're not hurting anyone . . . once we're done, take the money, go look after your family, plant your flowers or whatever the hell you want to do" (Alqueres, 2013).

Though the details are murky, Mike and Rob are due to meet another party. Upon their arrival at the appointed place, however, the driver of the second car leaves the rendezvous point and signals

Figure 3. Image from *The Flying Man* Depicting an Attack (Alqueres, 2013)



Figure 4. Image from *The Flying Man*: The Flying Man Attacks Mike's Car (Alqueres, 2013)



for them to follow. They do, as even Rob begins to sense that something is amiss. While on the freeway, the driver of the second car honks his horn and tries to wave to Mike and Rob, urging them to slow down (Rob: "He wants to say something—get closer"), which is the final straw for Mike. Reluctant throughout the evening, he now declares, "I'm not doing this. We're getting off on the next exit, okay? I'm done." At that moment, the Flying Man appears (see Figure 3).

The figure crushes the lead vehicle, pivots, and runs with inhuman speed alongside. Before the duo can attempt an escape, the Flying Man launches into the air, lands on the highway before them, and plows violently into the vehicle (see Figure 4). The scene ends abruptly with a sickening crash and a black screen.

The action resumes with a narrated news report, a mélange of reporters' voices:

Three men have been found dead trapped in their vehicles . . . one body identified as Robert Costello, a former cop investigated for weapons trafficking . . . the survivor is unconscious, but doctors say he has no serious injuries . . . authorities will interrogate the man upon his recovery . . . Was he missed by the vigilante or spared? (Alqueres, 2013)

The scene shifts to Mike lying in a hospital bed as he regains consciousness and clearly recalls the events that led him there. He looks down at a tattoo on his left forearm, a child's face and the name Jimmy. At this point, Mike parts the curtain of his hospital

Figure 5. Image from *The Flying Man* (Alqueres, 2013)



room, and the Flying Man appears, hovering outside, seemingly watching Mike or waiting for him (see Figure 5).

Among the central questions evoked by the film are: Should a figure like the Flying Man be considered a defender of the innocent, a bulwark against lawlessness, or a terrifying menace that threatens the social and legal institutions of a civilized society? This article describes the potential of *The Flying Man* to stimulate the discussion of these questions and serves as an example of the use of visual artistic media in social education.

FILMS AS VISUAL ART PEDAGOGY

Secondary educators across the curriculum have historically asserted the primacy of issues-analysis instruction (Russell, 2009). This is particularly the case with the social studies, which have the distinction of being a group of disciplines gathered under a single title. Within a single career, a social studies teacher can expect to be responsible for a diverse set of courses and topics that include history (both American and global), government, geography, and law. The ability of social studies teachers to marshal a large number of resources and strategies is essential to achieving student success, as is the case with teachers, across the curricular spectrum, who are required to address a range of topics that complicate effective engagement and instruction. What social studies teachers appreciate, then, are materials that can serve as thematic nexus points for these topics, all converging toward the overarching goal of “developing an informed, democratic citizenry engaged in understanding and influencing policies” (Mathews, 2009, p. 249). Educators are committed to helping develop individuals who are “willing and able to address both the personal challenges of day-to-day living and the broader problems that face our society” (Houser, 2005, p. 46). To further this goal, a heavy emphasis must be placed on what Mathews (2009) calls “critical literacy,” a skill set that moves beyond routine decoding of a given text’s meaning and toward the ability to “[raise] questions about who gains and loses by reading a text” and to critique a text’s message (p. 249).

This kind of critical literacy is important across any number of disciplines, but it is particularly vital in social studies instruction. Learning history is “not simply a matter of fact finding, but a process of finding meaning in facts sought and encountered” as well as, “relating to a web of actors, events, and interpretations” (Gabella, 1994, p. 343). Moreover, students must be capable of understanding the role of perspective, to identify those “embedded in various

representations” like visual media, and “to critically examine which voices are represented and which are missing” (Mathews, 2009, p. 248). Lewison, Flint, and Sluys (2002) identify four characteristics of critical literacy that should be present in classroom social inquiry: (a) a disruption of the “commonplace,” (b) the incorporation of multiple perspectives, (c) a focus on sociopolitical issues, and (d) the promotion of social justice through action (p. 382). *The Flying Man*, to varying degrees, includes elements of the first three criteria, but the degree to which the fourth, social justice through action, is present is determined by the teacher (Thornton, 1991).

Developing disciplinary literacy in the social studies, however, is usually focused more or less exclusively on text and text-derived imagery. Obviously, this need not be the case, living as we do in a culture replete with visual media. Seixas (2001) argued for a refocusing of the social studies around the notion of *text* to refer more broadly to cultural artifacts, including such disparate items as “grocery lists, books, songs, buildings,” film, and video (p. 545). There is great potential in the role of a “visual culture” in the classroom, which can encourage students to actively critique visual media rather than absorb it passively (Mathews, 2009, p. 249). As an artistic medium, film has the “capacity to generate emotion, to stimulate and express the ‘feel’ of a situation, individual, or object,” much beyond the power of traditional resources (Eisner, 1991, p. 552). Mathews (2009) points to the inherent value in film’s potential as “a legitimate medium for promoting both aesthetic pleasure and social critique” (p. 249).

This potential for social critique is vital for social studies educators, as with teachers across all disciplines. Duncum (2002) describes how a visual culture can help students “study images within their context as a social (and political) process” (p. 20), and Cromer and Clark (2007) note the value of a visual in which students can “catch a glimpse of the political and cultural zeitgeist” of a time, place, and nation (p. 578). The traditional use of visual media, like video and film, in the classroom has broadened in recent years to include more contemporary examples, like graphic novels (Cromer & Clark, 2007), reality television (Mathews, 2009), and hip-hop culture (Houser, 2005).

FILM AND VISUAL ART IN THE CLASSROOM

There has been considerable research into how film is used in classrooms, in particular, how it might be used more effectively to develop critical literacy skills (Hobbs, 1999; Marcus, Paxton, & Meyerson, 2006; Metzger, 2005; Russell, 2009; Weinstein, 2001). Marcus (2005) examined the use of film to empower historical thinking in secondary history classrooms, while Hess (2007) focused on the development of similar skills with documentary films in elementary social studies instruction. Marcus and Stoddard (2009) considered a similar role for documentary film in secondary schools and their impact on students’ beliefs about such resources as a representation of the past. A wide array of educational media is available to most teachers across disciplines; commercially produced movies innately appeal to students, given their

status as “products of mass popular culture” (Metzger & Suh, 2008, p. 90). In the social studies, the capacity of film to help students “visualize the past as a kind of vicarious experience” (Metzger & Suh, 2008, p. 90) holds great promise for teachers of a subject that many students find, at best, somewhat dry. More than just the value of promoting historical empathy, though, films can help students grasp the antecedents to contemporary events, or to consider analogues to those events which can lead to a more critical grasp of their importance (Metzger, 2005). At this point, the use of film as a pedagogical tool is largely accepted as “a given” (Marcus, 2005, p. 61). According to one study, 92% of teachers surveyed reported showing all or part of a fictional film once a week or more (Marcus & Stoddard, 2007). Outside the classroom, film and visual media (e.g., video games) are possibly the most important component in the way Americans view the world around them (Rosenstone, 1995, 2006; Seixas, 1994a; Stoddard & Marcus, 2010).

Problematically, though, the use of visual arts like film can create obstacles. In a traditional classroom, films are most often shown by teachers as a form of reward or to occupy unused instructional time; they are often employed without preview, preamble, or post-viewing analysis (Russell, 2009; Stoddard & Marcus, 2010). This practice is especially problematic when a film’s impact, as relative to other more traditional texts, is considered. Butler, Zaromb, Lyle, and Roediger (2009) found that when students were asked to remember particular historical events, they tended to rely on examples from films shown in class rather than on text-based historical sources. A troublesome, but perhaps intuitive finding from the work of Seixas (1994b) and Stoddard and Marcus (2010) suggests that students tended to ingest the historical inaccuracies of the film without question (p. 84). Though such inaccuracies can be merely reductive, Metzger (2005) recalls leaving a theatre after seeing *Kingdom of Heaven*, set in the context of the Crusades, and hearing one teenager say to his friends, “So the Crusades were caused by one crazy king” (p. 84).

Not only are students likely to retain inaccuracies they gather from film, they generally do so uncritically. The tendency to accept the conclusions inferred from and offered by film is a habit that students tend to adopt, certainly fostered by their innate belief “that the credibility of a source varies inversely with the degree of apparent human craftsmanship” (Gabella, 1994, p. 347). That a film seems to be such a massive endeavor to produce (as, in fact, it is), a viewer tends to accept the perceived dominant narrative of that film, assuming that if it were inaccurate, such discrepancies would have been caught and rectified during the production process.

Marcus (2005) found that students use film as a “[bank] of information from which to make a withdrawal,” a way to “acquire and memorize information” (p. 63). This attitude is enabled, in many cases, by teachers who often use film in as uncritical a manner as their students. Metzger and Suh (2008) examined two secondary teachers’ use of film in the classroom, in particular their inclusion of historical movies. They point to a common problem for many teachers: a limited approach to film as a teaching resource, including the failure to “discern wider historical themes and messages

in the film” (p. 97) and an unwillingness to critically confront the more controversial elements, including violence and sexuality. Film has great potential and advantages for furthering social inquiry but, used in a passive, traditional manner, they do not meet the criteria established by Scheurman and Newmann (1998) for “authentic intellectual work”: construction of knowledge, disciplined inquiry, and value beyond school (p. 24).

How, then, should a film like *The Flying Man* be used in the classroom? Stoddard and Marcus (2010) offer some general guidelines for the use of visual media: start with a clear purpose, use a graphic organizer or scaffold during viewing, and, most importantly, actively engage students in determining what they learn from the film through “discussion, written reflection, [and] critical analysis” (p. 89). Russell (2009), too, encourages teachers to use in-film activities but also cautions against assignments that distract (or detract) from engaging with the film. Students will often interpret activities to be completed during a film as an implicit indictment of the film’s quality; they surmise (not without reason) that if the movie has any value, there is no need for an external tool to keep them focused. However, the purpose of in-film activities is not to guarantee student interest, but student engagement.

Metzger (2005) describes what this active application of critical analysis may look like in concrete terms: debating a movie’s interpretation, rewriting a crucial scene from a different perspective, or writing a summary for a hypothetical sequel or prequel film. Cromer and Clark (2007), in advocating the use of graphic novels in the classroom, suggest specific questions as a framing scaffold that would also be useful for film analysis:

- What are the main events and in what sequence did they occur?
- Who were the people involved? Who exercised agency and in what ways?
- Who has been omitted from this account?
- From whose perspective is this narrative told?
- How would you describe relevant aspects of the larger historical context of these events?
- Is there more than one story told here? Would you call these stories competing or complementary stories? (p. 588)

Marcus and Stoddard (2010) describe how teachers may use strategies like Socratic seminars to analyze not only the content and perspectives of a given film, but also the “context in which the film was produced and the backgrounds of who produced it” (p. 86). Gunn (2012) notes that films are as much primary documents as any traditional text, a “source of information about the time of their creation” (p. 647) (cf. Briley, 1997; Marcus & Levine, 2007; Marcus et al., 2006; Metzger & Suh, 2008).

Perhaps more important than specific pedagogical strategies, however, is the understanding of what Mathews (2009) calls a “gaze” (p. 254), the perspective that students bring to visual art, as well as the perspective(s) adopted by the piece’s author/creator. Matthews asserts, “Students need to critically examine what social, historical, and political forces impact the particular gaze that they and others are using when they view and act on the world” (p. 254). This

understanding is rooted in a constructivist faith in the power of “[asking] learners about what this knowledge means, what it does, and what new understandings might come from studying it” (Garrett, 2011, p. 320).

The students’ gaze in engaging with a film is strengthened, even activated, by agency. Werner (2002) suggests that students require a sense of authority to engage actively with visual media, to be positioned as “interpreters” (p. 403). The tendency of students to receive a film’s content and interpretations uncritically, however, can make this perspective difficult. This trait can be moderated by equipping students with the tools to engage with visual texts, including “appropriate background knowledge, relevant concepts, insightful questions, and supportive dispositions,” what Werner describes as “open-mindedness to alternative readings, and a willingness to question interpretations” (p. 403) (cf. Case & Wright, 1997). Interpreting visual media’s gaze is, by necessity, an active process. Marcus (2005) recommends that teachers help students move from a passive acceptance of a film’s content to a critical, inquiry-based stance:

I suggest that instead of looking at films as a mirror, teachers ask students to invoke the image of a lake. At times, a lake is calm and reflects a more accurate, though still slightly distorted, picture of the past. At other times, wind or children playing and skipping rocks create ripples in the water, further warping the image reflected. Some films have more ripples than others (e.g., the intent of the director, the film as entertainment or a profit-making enterprise, a lack of research, various political agendas and societal attitudes, or the atmosphere at the time of the film’s release). (p. 64)

Adopting this stance as educators, and promoting it with our students, makes visual media like *The Flying Man* a much richer source of social commentary and gives us a tool with which to guide our students to pursue answers to powerful questions.

THE VALUE OF *THE FLYING MAN*

Gravity, a 2013 film directed by Alfonso Cuarón, depicts, in stunningly realistic detail, a disaster in space. Starring Sandra Bullock and George Clooney, the movie, hailed for its groundbreaking special effects and unnerving verisimilitude, grossed over \$700 million worldwide and won seven Academy Awards (Shoard & Pulver, 2014). At the same time, many advocates of space exploration hoped that the movie might spark renewed interest among the American populace for ventures beyond the atmosphere or, at the minimum, an increase in funding for the National Aeronautics and Space Administration (Gach, 2013).

In the hands of an effective teacher, a film like *Gravity* that only inferentially includes content knowledge about the U.S. space program, and primarily shows the hazards and obstacles intrinsic to working in space, is infused with powerful opportunities for inquiry. The content can evoke such questions as: What priority should space exploration have in our national policy? Is it moral

to send human beings, even those who are willing and enthusiastic, to an environment where survival is so challenging and where the tangible benefits gained are negligible? Equipment produced by three different nations is featured in the film and can lead to additional questions such as: Is there such a thing as “ownership” of space? Can there be “territory” or “borders”?

The value of films like *Gravity* and *The Flying Man* is not only in their content and themes. *The Flying Man*, in particular, has the virtue of a relatively subversive perspective, one that would be appealing to students who are eager to “read as insiders and get the joke” (Mackey & McClay, 2000, p. 196). More importantly, *The Flying Man* presents an opportunity for teachers to help students engage with what Britzman terms “‘difficult knowledge’ . . . the representation of social trauma and the individuals’ encounter with them in pedagogy” (Pitt & Britzman, 2003, p. 755) (cf. Britzman, 1998).

The subversive depiction of a “hero” committing violent attacks without explanation or consequence has been used in a variety of formats. For instance, from 2003 to 2006, comic book artists Greg Rucka and Ed Brubaker (2003) produced a limited 40-issue series called *Gotham Central*. This series followed police officers in the fictional city most famous for its resident vigilante, Batman. In this depiction, Gotham’s most famous resident is rarely seen; instead, the authors work to show how the presence of such a figure could impact the behavior of everyday people, especially law enforcement personnel who not only had to deal with the “villains” that Batman was fighting, but also the enigmatic “hero” whose commitment to justice could just as easily be interpreted as a willful flouting of the legal process.

The Flying Man gives a teacher the opportunity to highlight a subversive perspective on the “superhero” trope, which has become hugely popular in popular culture and visual media in recent years. Students might be asked, for instance, to analyze the actions in *The Flying Man* by answering such questions as: Is a criminal background sufficient cause or justification for the Flying Man’s actions? Does Mike do enough to absolve himself from his criminal intentions (e.g., expressing anxiety and reluctance, ultimately trying to drive away just moments before the vigilante’s arrival)? When Rob retrieves a gun from the back of the car, is that representative of criminal intent? Does the fact that Rob (or, as he is inferentially referred to, “Robert” Costello, a “former cop investigated for weapons trafficking”) has a criminal background justify intervention by the titular character? At what point in the film are lines crossed?

What makes *The Flying Man* useful in a classroom setting is the fictional context it creates for real dispute and discussion. Hypothetical in-class arguments about law, justice, and morality may wander far afield and ultimately incorporate any number of extraneous themes, often anecdotal in nature, an experience that any veteran teacher will attest is depressingly common. A lesson derived from, and focused around, a self-contained “case study” like a short film can minimize those pitfalls.

One question that is hinted at but unresolved in *The Flying Man* is motive. Near the end of the film, while in the hospital, Mike looks down at the tattoo on his arm of a young boy’s face and the

Figure 6. Image from *The Flying Man* (Alqueres, 2013)



name Jimmy. It would be reasonable for students to assume that this is Mike's son; it would also be justifiable to think of Jimmy (and Mike's pressing need for money) as a major motivating factor in his collusion with Rob. What is interesting, from a classroom perspective, is the degree to which students may infer a benign or a criminal motive on Mike's behalf. The question isn't just: What is Mike doing but also: Why is he doing this, and does it matter?

Any critical analysis of *The Flying Man* should include a concrete assessment of the themes inherent in its content, as well as their prioritization by the teacher. Surveillance, for example, is a topic that is rich with possibility for social inquiry, particularly when contextualized within current or historical events. Vigilantism, too, is a theme that is reflected throughout U.S. history (for instance, the Regulator movement in North Carolina prior to the American Revolution), not just in the fictional universe of superheroes. Heroism is another topic that can form the basis for classroom inquiry as a social phenomenon and not just as a function of fictional "powers." Joseph Campbell's (1972) depiction of a traditional hero has come to mean, in popular American culture, an extraordinary figure who acts for the public good in a disinterested manner. Berson and Berson (2001) point out the intellectual lassitude that may result from a reliance on "heroes," fictional though they may be. "[Their] power and invincibility . . . provide an imaginary comfort, that no matter what may happen and how horrible people may act, there is someone who can protect us. The super hero represents safety, fairness, and justice" (p. 7).

In *Teaching History for the Common Good*, Barton and Levstik (2004) describe how the study of heroes typically focuses on individuals (for example, George Washington and Martin Luther King, Jr.), as a way of "[saying] something about how people should be" (p. 102). The questions raised by *The Flying Man* are deeply rooted in what "heroic behavior" entails and whether the film's central character is behaving in a manner that encourages the development of a particular kind of character among students (p. 104). But does this behavior describe *The Flying Man*? Is the enigmatic figure that kills alleged criminals the protagonist of the story or the antagonist? Whose values does he defend?

THE FLYING MAN IN THE CLASSROOM

The Flying Man's enigmatic nature can leave teachers and students with a simple though vital initial question: What, ultimately, is the

film about? Though its inscrutability makes it highly adaptable for classroom use, it is worth considering what the film, through its creator, is attempting to convey about heroes, heroism, vigilantism, and society.

The power of *The Flying Man* lies not only in its brief, though thrillingly constructed, action sequences. It also lies in the filmmaker's ability to provoke viewers with a series of both overt and implicit questions: What sort of society do we want? What is the role of law? What freedoms should be moderated (or subverted) for more tangibly immediate benefits, like personal security? These questions, which are inescapable while viewing the film, point to the power of visual media and simultaneously present a promising opportunity for educators.

In the final scene, as Mike wakes up in the hospital and looks at the tattoo on his arm, the disparate radio accounts heard in overlapping fashion coalesce into one voice, a voice that presents the ideas that Alqueres is conveying to the viewer (Alqueres, 2013):

Is this the justice we want after centuries of law development and human rights? What is, after all, being a good citizen? If this being acts in absentia of our institutions, have we failed as a society? Maybe. But history has shown that any form of tyranny cannot prevail. How many more family members will lose their loved ones executed without fair judgment? Those who call him "hero" today may consider him "enemy" tomorrow.

It seems clear, from this sentiment, that Alqueres is asking the viewer to consider the inherent danger in a seemingly all-powerful figure, exacting and doling out justice outside of conventional institutions and without appeal. Though this is not a literal phenomenon, the issue of extralegal vigilantism is not only significant in the social studies but is also an historical and contemporary phenomenon that is consistent with Hess' (2002) concept of "controversial public issues" (CPI), defined as "unresolved questions of public policy that spark significant disagreement" (p. 11).

Given the well established advantages of the inclusion of CPI in social studies instruction—including fostering democratic citizenship (Parker, 1996) and compelling students to "identify and analyze their own values and the values of others" (Soley, 1996, p. 10)—it is regrettable to see it so rarely utilized in social studies instruction. Hess (2002) noted the reasons why CPI is relatively uncommon in the classroom: (a) the issues are complex and thus tend to be time-consuming, a particular challenge in light of increasing demands for accountability and testing; and (b) the topics can be difficult, both emotionally and pedagogically (p. 14). The value of building a CPI-focused activity around a film like *The Flying Man* is that it can effectively reduce many of the practical impediments to such discussions. This is especially so in light of the film's relative brevity and the manner in which, by presenting a sort of visual "case study," a platform which includes the essential elements outlined by McDonnell (2002): (a) facts (even though, in this case, they are fictional); (b) issues; (c) arguments (constructed by students and fostered by the teacher); and (d) decisions about those issues.

Events in the daily news are often a source for inquiry into what is ultimately the most profound question, “What is justice?” Given the complexities of local, national, and international law that are beyond the background knowledge of the teacher, thoughtful selection is required. If the teacher is able to direct the students to the resources that will allow an informed discussion and decision, contemporary events offer a rich resource for adopting a CPI approach to discussing this fundamental question.

LIMITATIONS TO USING VISUAL MEDIA IN THE CLASSROOM

There are limitations to how visual media like *The Flying Man* might be used in the classroom, many of them prosaic: access, time, and permission from relevant authorities (disclaimer: the film does contain several mild expletives). Others are more profound, from the epistemology of truth and justice to the depiction of violence. There are comparatively few studies of the decision-making processes used by teachers regarding how to use films in the classroom (cf. Marcus, 2007; Metzger & Suh, 2008; Stoddard, 2007, 2009). A more important issue, however, is the degree to which students are capable of effectively critiquing visual arts and media. Mathews (2009) is concerned that “students do not have the skills to become more reflective about the ethical choices they make as they interact with popular culture” (p. 250). This is a legitimate worry, especially when we consider the tendency among young people to implicitly accept the assertions of visual narratives. Of course, one of the most reliable strategies for learning is by doing; as Goldsmith (2002) points out, “like any other esthetic insightfulness, the ability to ‘read’ images that portray character, mood, and tone must be developed through experience” (p. 2).

CONCLUSION

Despite these concerns, *The Flying Man* is an engaging, powerful tool for critical social inquiry. Visual media, like other visual arts, have the same ability to promote democratic values as traditional text-based sources. Popular culture, often criticized for its pervasiveness, crassness, and materialism, still can function as a mechanism for these values. Our default acceptance of the “hero” myth and its assumptions—that such figures act on our behalf, ethically if extralegally, and our trust in them should be complete—has the disabling tendency of reducing viewers to the status of “pedestal-gazers” (Meyers et al., 2009, p. 11). But using films like *The Flying Man* effectively, and pairing these resources with active social inquiry, can help our students reach the understanding described by Garrett (2011): “in being thoughtful about our social world we must acknowledge the capacity for doing terrible deeds, the ways in which individuals work against daunting circumstances, and finally about the ways that we, as individuals, will act in the world” (p. 321). The examination of the “hero” myth and its underlying assumptions offered by *The Flying Man* can equip students to actively build their own informed belief structures about contemporary social issues.

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ESSAY BOOK REVIEWS

ACADEMIC/PROFESSIONAL TEXT

DANIEL OSBORN, *JOURNAL OF EDUCATION*

Understanding the School Curriculum: Theory, Politics and Principles

ALEX MOORE

New York, NY: Routledge. 198 pages.

ISBN 978-0-415-63057-3. \$44.95

In *Understanding the School Curriculum: Theory, Politics and Principles* Alex Moore, Professor Emeritus, Institute of Education, University of London, UK, problematizes a seemingly uncontroversial topic—the school curriculum. In nine chapters, Moore presents a rich analysis of critical topics: “a curriculum for the future,” dynamics, definitions and purposes, knowledge and learning, internationalization and globalization, decision-making, types of curricula, and alternatives in practice.

Rather than taking curricular content as self-evidently neutral, selected and configured according to scientific rigor, Moore challenges such presuppositions and suggests that the school curriculum is value-laden and represents a particular vision of society and its strivings. Relatedly, the canonization of certain curricular content within academic disciplines displaces other possible forms of knowledge. For Moore, the presence or absence of certain content in school curricula is emblematic of negotiations between different shareholders who seek to frame educational experiences around philosophical and ideological positions. In this respect, various progressive, conservative, and neoliberal parties contend for the school curriculum to transmit certain content and produce certain types of citizens reflective of their respective visions of society. In this way, the curriculum, rather than being an unimpeachable storehouse of knowledge unfettered by subjectivities, is home to ideological battles often waged subtly and under the guise of the certainty and truthfulness of knowledge. By unpacking the school curriculum in this way, Moore challenges the commonly held assumption that school knowledge is devoid of ideological influence. Moreover, by confounding commonly held assumptions of knowledge and schooling, Moore invites the reader to reevaluate school curricula and thus, become more cognizant of the deliberate yet unspoken choices made in selecting the knowledge to be taught and the schooling students will experience. Without indicting school curricula for failing to be innately objective, Moore fosters his readers’ consciousness of how certain ubiquitous features of school curricula become normative and perceived as immutable and natural.

In the introduction to the text, Moore addresses the issue of updating school curricula to meet the needs of the future. Moore presents this as a perennial issue that has preoccupied policy-makers and theorists for over a century. In spite of the longevity of this

concern, Moore contends that the future is not easily predicted, and the trajectory of human development cannot be traced so far in advance. Additionally, Moore poses the question, “Whose future is it that curriculum is seeking to prepare young learners for, in any event?” (p. 5), thereby stymying any attempt to presume there is a preordained future that should be reflected in the skills and knowledge embedded in school curricula.

Instead of designing curricula as if the future were known, Moore uses the introduction to establish a recurring current of thought that underpins each chapter of the book—the school curriculum should never be static. Instead, it should be malleable and adaptive. Yet, such malleability can only occur when the parties vested in varying social, political, economic, national, and international interests can render the curriculum dynamic instead of paralyzed by ideological disagreements. Moore explains that there is,

a need for the concept of curriculum to remain an open one that embraces and thrives on—rather than becoming stagnated or straitjacketed by—a certain overriding tension that exists not only within curriculum policy and practice itself but indeed in how we experience and manage our lives more widely. (p. 14)

In spite of repeated calls to update the curriculum so that it addresses the needs of the future, Moore contends that national curricula tend to be conservative and slow to change. With globalization and the digitalization exacerbating the rate of cultural, social, and political change across the world, informed by his international perspective, Moore considers this to be an opportune time to “contemplate some radical curriculum possibilities and changes” (p. 9). Throughout the text, Moore explicates the form some of these changes could take while deconstructing the school curriculum to expose subjectivities.

The basis of Moore’s argument and his enumeration of the contentious issues associated with curriculum design and implementation is that the curriculum should remain dynamic. This is in contradistinction to the tendency for curricula across the world to become ossified. Moore explains, “we should be conceptualising curriculum as endlessly unfinished and evolving” (p. 17) whereas “conservatising, reproductive forces on curriculum *work* may indeed be seen itself as anti-dynamic, placing restrictions on teachers’ capacity for experimentation and innovation” (p. 39). This open-ended understanding of the curriculum’s potential underscores Moore’s assertion that the school curriculum should not be considered natural, neutral, or definitive in shape. Instead, it is constructed, negotiated, and must remain open to scrutiny and development, described by

Moore as “*curriculum dynamikos*” (p. 17). Part of the dynamism in this approach is an understanding that deciding how to maintain the vitality of schooling entails making decisions regarding the type of school experience students will enjoy. Moore asks,

Should our curricula seek to promote actively *critical* citizens, willing and able to recognise and seek to address any perceived shortcomings in the society in which they live? Or do we want to produce a more compliant citizenry, which simply “buys into” existing dominant values and socio-economic arrangements and so reproduce them? (p. 20)

While not the only probing and provocative questions posed throughout the text, these queries speak to the concern that curricular matters are the product of perceived social needs, interests, and expectations. Schools can accomplish a vast array of feats, but settling on which are of the utmost importance to students and the societies in which they exist are not self-evident. Moore elaborates:

we need always to remember that alternative curricula are available to us, and that, however eager we are to accept our premise, that premise is itself saturated with all-too-easily ignored questions regarding the forgotten *histories* of school curricula and indeed of the very idea of the curriculum itself, so effectively “naturalized” has the term and the concept become. (p. 44)

With this appreciation that there are alternative curricula, Moore transitions to investigate the nature of knowledge and the types of knowledge that are taught in schools. Initiating this chapter, Moore asks:

Do we, for example, understand or construct knowledge—effectively, “reifying knowledge”—as some immutable entity that is “out there” waiting to be discovered regardless of who we are as individuals? Or do we believe that knowledge is socially and culturally mediated, partial and *produced*? Can knowledge be *both* these things, depending on what “kind” of knowledge it is? (p. 66)

Without exhausting the arguments found in this debate, Moore posits a more substantive statement in favor of schools maneuvering away from a curriculum premised upon students imbibing facts as though such a regimen of information translated into a truly edifying experience. Instead, Moore’s chapter devoted to knowledge is framed by the thesis that learning should supersede information transmission as the pinnacle of schooling. This vision of a dynamic curriculum of the future could engender students, cultivating their aptitudes toward problem-solving, exploring issues, forming informed judgments, and synthesizing various perspectives. Without rehashing “the child versus the curriculum” debate, Moore is able to pivot away from such *passé* dichotomies toward a *learning*-centered curriculum that weaves together knowledge and the cognitive development of students who are asked to wield knowledge in meaningful ways through multiple processes. With this in mind, he argues:

a learning-based curriculum concerns itself more with a set of questions around what learning is and how learning is developed—underpinned by a desire to help students develop as active, social and independent learners for whom education is not exclusively located in the school itself. (p. 68)

In problematizing knowledge, Moore also illuminates some of the longstanding prejudices associated with the selection of school knowledge while also challenging the reader to evaluate notions of *useful*, *powerful*, and *cultural* knowledge as identified by the school curriculum. He argues that the prejudice that commands substantial attention is privileging *academic* knowledge over *practical* knowledge in schools, the result of a longstanding positivistic stance towards knowledge found in schools and society. Moore writes:

in our endlessly uncertain individual and collective lives knowledge is (conservatively) associated with “certainty”—suggesting the possibility of replicability and universality—whereas action is more typically understood as provisional, contingent, risky, associated not with fixity but with change. (p. 72)

As a result, *academic* knowledge has historically been understood as objective and unproblematic. This is in contradistinction to the perception that *practical* knowledge, found outside of more scholarly pursuits, is not as easily organized and introducible with duplicability across diverse classroom contexts. For Moore, this has implications for the sort of knowledge integrated into the curriculum because it is deemed *useful* or *powerful*.

Such prejudices that favor certain forms of knowledge over others inevitably orient the selection and characterization of knowledge in ways that are culturally determined albeit presented as value-neutral. For instance, *useful* knowledge has recently been identified according to economic demands and the perceived desirability of equipping students with the requisite knowledge to contribute to the national economy. In contrast, the idea of *powerful* knowledge tends to be championed as emancipatory and empowering in a broader sense than knowledge that is transferable to the marketplace. Even still, Moore reminds readers that there is no definitive definition of what is *powerful*. Instead:

If knowledge has the potential to be *powerful*, we need—as with the notion of “useful”—to be clear about what we mean by it; and the fact that the term has enjoyed popularity in both left-wing and right-wing, progressive and traditional policy thinking suggests that it can mean very different things to different people. (p. 79)

Lastly, Moore takes issue with the tendency to safeguard certain forms of cultural knowledge in the school curriculum while refusing to admit marginalized alternatives. Certain cultural components of the curriculum are presented as possessing an intrinsic value, but Moore contends that there is a concealed sense of cultural superiority that informs the selection or exclusion of cultural products in schools. He concludes that tastes and preferences are

used to ascribe value to certain cultural products in schools. As such, like the prioritization of *academic* over *practical* knowledge, and the use of market or ideological forces to identify *useful* or *powerful* knowledge, *cultural* selections are subjective and need to be submitted to continued scrutiny rather than being considered beyond reproach.

Many of the curricular issues Moore tackles have underpinned curriculum theory and design across the globe for the better part of a century. As the text progresses, Moore introduces two more contemporaneous topics: the advent of digital technology and globalization. Moore introduces digital technology as a catalyst demanding that the curriculum be responsive to innovations in the production and dissemination of information. At the same time Moore does not conclude that technology is a panacea for all the problems plaguing an outmoded curriculum in need of revitalization. The promise of technologies such as the Internet, according to Moore, is that they allow for discovery through learning based around research. Such learning experiences enable more circuitous experiences than the fixed, linear, and preordained practices used in many schools. Yet, this promise is not always actualized when technology is coopted into the curriculum. Moore recognizes how the radical nature of such digital technologies are often domesticated in schools and put to the service of reinforcing existing practices where finding the *right* answer becomes of higher import than the experience of problem-solving.

The second contemporary issue Moore introduces is internationalizing the curriculum, an imperative brought on by globalization. Moore differentiates between *internationalizing* and *globalizing* curriculum. He describes internationalization as involving the integration of new content that expands the scope of the curriculum to include more global themes and issues. Globalizing is defined as the production of a curriculum that is not adopted solely within a particular nation-state but rather is implementable across the globe. Whatever urgency there may be to respond to global interconnectedness, Moore rather somberly concludes that school curricula remain centered on the nation, its history, economic concerns, and political interests. He writes:

Where globalism or internationalism does appear in *national* curricula, it typically does so as an unexamined (and consequently perceived as “low status”) element or topic or strand, and though there may be some commonalities across nations as to what to include in such elements (“sustainability” is a particularly popular item for inclusion), such commonalities tend to be fortuitous rather than planned. (p. 116)

In the concluding two chapters of the text, Moore directly confronts two of the undercurrents that are omnipresent throughout the text: *decision-making*, and *hidden, absent, and lost* curricula. Explicating the decision-making processes of school curriculum design, Moore asks, “What purposes (overt and covert, conscious, and unconscious, articulated and concealed) might lie behind such decisions?” (p. 130). While the question of who decides what to include could easily have monopolized this chapter, Moore does

not consider this to be the most revealing question. Granted, various groups vie for power and position in order to be the most influential in making curricular decisions. Yet, importantly, the various interested parties presume the needs they speak to and wish to have respected in the curriculum are undeniable rather than constructed. Moore devotes this chapter to deconstructing this position and instead offers a countervailing understanding of decision-making in the curriculum. For Moore, ideology is ever-present in decision-making, and the concept of objectivity is a fallacy. Certain interests and agendas will always inform decisions regarding how to structure the curriculum and what content to include and validate or exclude and invalidate.

When evaluating the *hidden, absent, and lost* curricula, Moore explains, “it is not just a matter of *what* is left out, but of *why* it is left out; not just a matter of overlooking something as of lesser importance, so much as a deliberate expunging” (p. 153). In discussing the *hidden* curriculum, Moore describes how explicit reference to the values, ideologies, and interests that determined the form of the curriculum are left out of conversations in schools. As a result, the undeniable subjectivities that punctuate the curriculum are not revealed to students. Relatedly, topics that may be controversial and call attention to less palatable dimensions of society may be *absent* or *lost* depending on decision-makers’ willingness to allow students to grapple with such ideas and issues. Moore explains:

if our intention is to shield students, to “protect” them from troubling (and perhaps trouble-some) knowledge, we might reject uncomfortable, “difficult” knowledge altogether—especially if we are also guided by an aim to maintain a social status quo rather than to question it. If, on the other hand, we wish to produce a critically educated citizenry that might challenge the status quo, difficult knowledge might force itself more into the forefront of our reckoning. (p. 158)

The absence of potential forms of knowledge that may cultivate students’ awareness of social issues sanitizes the curriculum. Moore contends that the loss of such opportunities for students to explore these topics with teachers in schools diminishes the curriculum’s capacity to contribute to social justice. Through *hidden, absent, and lost* curricula, Moore attests that schooling becomes reproductive rather than revolutionary.

As a whole, *Understanding the School Curriculum* provides readers with the opportunity to unpack the curriculum of formal education by subjecting it to a type of scrutiny not often applied to schooling. In an age where the discourse of education is dominated by high-stakes testing and teacher accountability, Alex Moore confronts these topics. In order to focus on testing and standards for teachers, the school curriculum is taken for granted and exists as a readily available fount from which to evaluate student performance and teacher competence. Yet Moore undermines such assumptions by deconstructing the school curriculum and, in effect, making it possible for the participants in these ongoing discourses to pause and consider all that is implied or understated in their work as educators, policy-makers, and decision-makers. Moore’s book invites

the reader to ensure that the curriculum continues to evolve, and that the evolution occurs in a context of heightened awareness for the intricacies of curricular construction and the ambiguities inherent in those processes.

BOOKS FOR YOUNG READERS

THE ARTS AND SCIENCES IN EDUCATION

ELIZABETH NOLAN AND MICHELLE CARNEY, *JOURNAL OF EDUCATION*

A poetic mathematical voyage through the seasons, the inspiring story of an esteemed artist who overcame a severe injury that might have—but did not—end his brilliant career, a poignant biography of a revered singer who made a difference in music and in the movement for equal rights, and an inspired chronicle of a crucial year in the founding of the nation are the books we review in this issue that focuses on the arts and sciences in education.

Math for All Seasons

BY GREG TANG

ILLUSTRATED BY HARRY BRIGGS

Published by Scholastic Press, 2002

(Ages 5–8)

Award: Oppenheim Gold Award, 2002

Math for All Seasons is the second in a series of well-received picture-books for budding mathematicians created by Greg Tang. It follows *Grapes of Math* (2001), his *New York Times* bestseller and IRA Teachers' Choice Award winner. As in the previous book, Tang combines playful riddles and vibrant illustrations by Harry Briggs to teach problem-solving and strategic thinking to young students. It will come as no surprise to readers that Tang is an accomplished mathematician, holding BA and MA degrees in economics from Harvard and an MA degree in mathematics education from New York University (Tang, 2014). It is perhaps this combination of mathematical and pedagogical concept knowledge that allows Tang to make the complexities of strategic mathematical thinking accessible to young learners.

Tang writes that his goal is “encourage [ing] kids to think through problems rather than relying on formulas and memorization” (Tang, 2002, author's note). Through *Math for All Seasons*, he aims to teach four important lessons in problem-solving: (1) be open-minded, (2) think strategically, (3) practice time-saving methods, and (4) simplify problems by looking for patterns and symmetries. Just as importantly, readers will find Tang's riddles engaging, entertaining, and comprehensible.

Consistent with the title, each riddle represents a seasonal theme, such as summer fireworks, spring rain showers, and winter icicles. Tang writes with quick pacing, interesting vocabulary, and a repeated AA, BB rhyme scheme, making the riddles as much fun to read aloud as to solve. Briggs' richly colored, high-contrast computer-generated graphics complement Tang's writing while providing necessary visual support to readers. Together, the words and images will allow successful experiences for those developing grouping and counting strategies. Tang's riddle “Raining Cats and Frogs” provides an example:

They say it's raining cats and dogs. / Why not lizards, snakes, and frogs? / Next time the weather's getting wet, / Forget the forecast—call a vet! / Can you count the dots you see? / Try to add them cleverly. / Group them in a special way, / Make sums of ten this rainy day! (p. 4)

On one side of each two-page spread, the riddle is presented in large, bold font on a solid background color. On the other are sharp graphics of the object to be counted, which in this riddle are the bright dots on a collection of umbrellas. Complementing this layout are playful details such as a frog clinging to a downspout and lizard-shaped puddles that add interest without distraction.

In addition to visual supports, Tang embeds scaffolds within the riddles themselves. Each concludes with a helpful tip as to which grouping strategy to use. For example, “Double Delights” ends with the hint, “Instead of counting every one, / Double half and you'll be done” (p. 15). The last pages of the book provide an answer key featuring a thumbnail of each puzzle page that shows the grouping strategies and a mathematical equation expressing the solution. Teachers will find these visual models of strategic mathematical thinking a useful tool when using the text in the classroom.

Given the reader reviews on Amazon.com (n.d.), it is evident that teachers have developed many ways to use Tang's books in their mathematics instruction. Their ideas include using the riddles as problems of the day and asking students to first complete the riddle, then share the different grouping strategies they used to count the objects. Others have suggested cross-curricular activities such as teaching students to create their own math problems, writing corresponding riddles with clues to strategies, and designing appropriate graphics, thus joining mathematics, writing, and the visual arts. Additionally, the riddles can provide the basis for anchor lessons that can be referenced during problem-solving. Moreover, these riddles provide experiences that will likely develop the conceptual understanding of key ideas behind the operations of addition and subtraction highlighted in the *Common Core State Standards* (NGACBP & CCSSO, 2010). Tang maintains an interactive web page, www.gregtangmath.com, featuring more math games and puzzles that can be accessed both in and out of the classroom. A list of the other high-quality titles in his mathematic puzzle series is available on Tang's web page as well.

This book, as the others in Tang's series, offers another critical lesson in addition to his aforementioned goals. Tang questions the idea that some children are “naturally good at math” and offers an alternative explanation: these children have “learned to think about numbers and problems in more effective ways” (Tang, 2001,

author's note). Through his books, we gain evidence that success in math should not be attributed solely to innate mathematical abilities but can also be the result of learning to think strategically. Given ample opportunity to practice this kind of thinking over rote memorization, particularly when they begin to learn mathematics, all children can become good at math.

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A Splash of Red: The Life and Art of Horace Pippin

BY JEN BRYANT

ILLUSTRATED BY MELISSA SWEET

Published by Alfred A. Knopf, 2013

(Ages 5–8)

Awards: NCTE Orbis Pictus Award for Outstanding Nonfiction for Children, ALA-ALSC Notable Children's Book, Robert F. Sibert Honor Book, Schneider Family Book Award

"Make a picture for us, Horace!" (p. 5) was the request Horace Pippin, the acclaimed artist, heard first from his family, then his classmates and coworkers, and finally the soldiers with whom he served in World War I. As a child, Horace used his big hands at home and at various jobs to help his loving grandmother and mother with family chores and expenses. A self-taught artist who in these early years used scraps of paper and charcoal to draw the pictures "in his mind" (p. 4), Horace acquired his first art supplies when a box arrived at his home, the prize for winning an art contest he had read about in a magazine.

Whenever he was asked "Make a picture for us, Horace!" he always responded with a picture, until a severe war wound to his right arm made drawing impossible. One evening, after Horace had returned home to West Chester, Pennsylvania, and married Jennie Wade, he sat by the fire and saw in his mind's eye the stories his grandmother had told of her days as a slave and those from the Bible. He noticed the poker by the fireplace and, with his uninjured left arm, grasped his right wrist and scorched a picture into the wood. Now, when the neighbors said "Make a picture for us, Horace!" he could and would.

As his right arm grew stronger, Horace returned to painting, using the few supplies that were available to him and taking three years to complete one painting, with a splash of red and a frame with small sculptures. More pictures followed, and he began to display them in storefront windows and in a restaurant. Although

Horace's pictures were admired, none were sold, even at a price of \$5.00. Fortunately, the paintings came to the attention of a local artist who knew N. C. Wyeth, a famous painter who lived nearby. Wyeth agreed to come to see Horace's paintings and, after studying them, asked if there were more. Finally, Wyeth spoke the life-changing words, "You should have your own art show. A one-man exhibition, right here in West Chester" (p. 25). Horace's show was noticed, not only by the local people but also by newspaper and magazine reporters and an art dealer who agreed to help him sell his paintings. After many years of struggle that would have ended the career of a less noble man, Horace Pippin's paintings were hung in galleries in big cities and museums and were purchased by art collectors. Today, Horace Pippin is acknowledged as a master American artist whose paintings are displayed in museums in major cities including Chicago, New York City, Philadelphia, and the nation's capital.

Words cannot capture adequately the engaging text and vivid images produced by Jen Bryant and Melissa Sweet, the award-winning author and illustrator whose collaboration makes this book a treasure trove for young readers and the adults who read with them. Horace Pippin's inspiring life story is told in poetic prose and complex illustrations, themselves works of art that vary in style from silhouette to collage to portrait, often with Horace Pippin's words embedded in the image and always with a "splash of red." The book's words and mixed media illustrations will captivate young writers and artists and those who appreciate text and image. The life story of Harold Pippin will inspire those who have been struck by adversity with a model to emulate. Perhaps most importantly, the enduring promise of what is "in the mind" to create images for others to enjoy is among the innumerable reasons to celebrate this remarkable book.

Teachers and parents will welcome the opportunity to introduce this book to young readers, but one reading will be insufficient. The picturebook's illustrations and compelling story invite the reader to revisit it again and again. The simple yet powerful language, presented traditionally on the page or creatively within the illustrations, draws the reader into the story of an extraordinary man. The rich, varied illustrations invite a detailed "reading" of the images and the text embedded within them. Readers, younger and older, will return to this book again and again with appreciation for a legendary artist and the talented women who have given us his story.

A Splash of Red is a gift to a teacher; the ways it can be used in a classroom are limited only by the imagination. Among the opportunities that occur to this reviewer is to focus the students' attention on the color red in the title and in the subtle inclusion of this color on every page. Students might use their observations to consider how a theme can be enacted in images as well as words. Another opportunity is found in the references to Horace Pippin's grandmother's days as a slave and to the war that caused his injury. These times can become topics for class projects that inform students of the power of history to affect the lives of those who live and those who remember. Students might also study the lives of

other significant contributors to our cultural heritage and, using the resources of the Internet, create a biography that relies on and is illustrated with original documents. Finally, students can use the Internet to research the paintings of Horace Pippin and create a portfolio for the classroom library, complete with captions that tell the title of the work, the date it was painted, and where it is now exhibited.

The Voice That Challenged a Nation: Marion Anderson and the Struggle for Equal Rights

BY RUSSELL FREEDMAN

Published by Clarion Books, 2004

(Ages 9–12)

Awards: Newbery Honor Book, Robert F. Sibert Informational Book Award

Russell Freedman, an award-winning author of nonfiction for young readers, captures in words and images the life of Marion Anderson, who in pursuing her love of singing became “an activist in the struggle for equal rights” (p. 91). *The Voice That Challenged a Nation: Marion Anderson and the Struggle for Equal Rights* tells the story of a renowned singer who became a legend.

Among the notable qualities of this book is Freedman’s reliance on a number of “first-person accounts” (book jacket) to create this enduring biography of a remarkable woman. These accounts include memoirs, autobiographies and biographies, interviews and reviews, newspaper accounts, and scholarly articles. Predominant among them is Marion Anderson’s memoir, *My Lord, What a Morning*, ghostwritten by Howard Taubman, the critic who also wrote a laudatory review of her first concert at Town Hall in New York in 1935. The resources also include a biography based on Marion Anderson’s private papers and told with the support of her family; a memoir written by her accompanist Kosti Vehanen; an autobiography of civil rights activist Walter White; interviews with the singer; scholarly articles; writings about Eleanor Roosevelt, who played a prominent role in her life; and books on race relations. Informed by these historical resources, Freedman has created a compelling account of the life of an acclaimed singer and her place in our nation’s history.

The book opens with an event that proved to be significant in the struggle for civil rights: the denial of Marion Anderson’s own right to sing in Constitution Hall, an historic venue in Washington, DC. Freedman’s words depict the harsh realities of America’s past and impel the reader to continue.

Marion Anderson had been applauded by many of the crowned heads of Europe. She had been welcomed at the White House, where she sang for the president and first lady, Franklin and Eleanor Roosevelt. She had performed before appreciative audiences in concert halls across the United States. But because she was an African American, she had been denied the right to sing at Constitution Hall, Washington’s largest and finest auditorium. (p. 3)

In the subsequent chapters, Freedman chronicles the story that led to this event describing Marion Anderson’s life from childhood to adulthood. He portrays in words and photographs the determination and work ethic of the talented singer, while weaving into the narrative the social and political context of the time. The highly regarded author of over 40 nonfiction books, including *Lincoln: A Photobiography* (book jacket), Freedman captures humanity in an inhumane, racially divided America. He describes Marion Anderson’s modesty, drive, and strength of character, which that paved the way for the Black American artists who followed her.

As a child, Marion Anderson endured poverty, but she also sang in three choirs and other venues, all without formal vocal training. She was also a self-taught pianist who supported her family with her talent. To reward her kindness, the members of her church raised money for her to receive formal training. Once her career in the United States took hold, she traveled to Europe to further her studies, where she performed in venues all over the continent. However, upon returning to the United States, while she was applauded for her talent, Marion Anderson experienced both de jure and de facto racism. Freedman uses Anderson’s own words to portray this harsh but subtle reality: “Somebody doesn’t always come right up to you and say, ‘you can’t have this, you can’t have that’” (p. 80).

As he nears the middle of the book, the author circles back to the controversy with which the story began, the denial of Marion Anderson’s right to perform at Constitution Hall. He then tells the story of a different event, a concert at the Lincoln Memorial and those who made it possible. Through the accounts of Marion Anderson’s agent Sol Hurok, Eleanor and Franklin D. Roosevelt, Harold L. Ickes, and NAACP chief Walter White, we learn how this event came to be and how these details became known to Marion Anderson herself. The account of this historic free concert is the climax of the book, and the following chapters describe how this event shaped Marion Anderson’s future and that of other Black artists.

Freedman writes of the significance of the Lincoln Memorial event: “The concert is recognized today as a milestone in the struggle for equal rights” (p. 71). The magnitude is captured in a particularly powerful photo, a two-page spread of the Mall crowded with approximately 75,000 people. Another telling and moving illustration shows the program for the concert, which includes the memorable and powerful line from the Gettysburg Address: “Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal” (p. 61). Yet the text on the opposite page makes clear to the reader the inequities Black Americans faced: “Since no hotel would take them, they had been invited to stay at the Washington home of Gifford Pinchot, the former governor of Pennsylvania” (pp. 60–61). The placement of the program opposite this text is just one example of the ways Freedman exposes to the reader the conflict between the nation’s Constitution and the laws of the time.

This well-researched account of Marion Anderson’s life also brings to the forefront the power of prominent as well as ordinary

citizens to influence social change. Particularly notable was Eleanor Roosevelt, who was the First Lady at the time. In a well-publicized letter to the president of the Daughters of the American Revolution, who oversee Constitution Hall, she resigned her membership and condemned their actions, thereby making the public aware of the discriminatory policy.

Although these historic events are central to the life and biography of Marion Anderson, we also learn of her other important achievements, including her performance as the first Black soloist at the Metropolitan Opera House and activities that extended beyond the stage, such as her appointment as a delegate to the United Nations in 1958.

This fine book is a rich resource for classroom teachers and for parents. For all readers, the narrative is an excellent way to learn about the struggle for equal rights that continues to be a quest for Black Americans. The book also describes the power of the individual to make social change. In the classroom, the book can provide an ideal mentor text to teach students about the importance of primary source documents when writing a biography and/or an autobiography. Set at a time in American history when the struggle for equal rights was beginning to draw national attention, the book is also an ideal way to initiate or continue the study of this critical movement in the life of the nation and the citizens who are the heroes of the story.

1776: The Illustrated Edition

BY DAVID MCCULLOUGH

Published by Simon & Schuster, 2007

(Ages 12 and up)

Awards: David McCullough has twice received the Pulitzer Prize and the National Book Award and is the recipient of the National Medal of Freedom, the highest award given to a private citizen.

The final book in this review is an illustrated version of David McCullough's *1776*, originally published in 2006. In addition to its great value as a historical narrative, this edition is an exemplar of the ways the arts and letters can enhance our understanding of history.

From the last week of August to the last week of December, the year 1776 had been as dark a time as those devoted to the American cause had ever known—indeed, as dark a time as any in the history of the country. And suddenly, miraculously it seemed, that had changed because of a small band of determined men and their leader. (p. 225)

These words capture the essence of a significant year in the history of what would become the United States of America as told from the perspective of the British and the Americans. Throughout the work, the author portrays events, people, and settings by integrating multiple accounts that include original letters, journals, memoirs, and newspapers.

A work worthy of the description “masterpiece,” this book is an inspired blend of well-researched, detailed text and stunning

primary source illustrations and documents. Throughout this edition are “paintings, maps, rare documents of a kind seldom accessible beyond scholarly circles—to illuminate and amplify the story of the most important year in the war that made America” (p. 8). The artifacts were drawn from such venerable institutions as the Library of Congress, the Metropolitan Museum of Art, and the New York Public Library as well as collections housed abroad. The impressive illustrated two-page spread portrays the individual events that affected history: the Battle of Bunker Hill, New Yorkers pulling down a statue of King George III on the day the Declaration of Independence was signed, the Battle of Brooklyn, and the Continental Army's historic victory at Trenton.

The visual qualities of the text amplify the impact of this exceptional work. For example, the color of the pages resembles antique parchment, and an eagle watermark adorns each new chapter page. Within the text are ten vellum envelopes, each bearing the seal of the United States Board of War and Ordnance, an institution created by Congress on June 17th, 1776 (John Adams Historical Society, n.d.). Within these envelopes are “37 facsimiles of rare and important letters, maps, and historical documents” (p. 9) related to the narrative on the previous pages. On an adjacent page, the documents are listed and described. An example of the power of these original documents to enhance the reader's understanding is a letter from Henry Knox to his wife that follows the chronicle of Knox's journey from Fort Ticonderoga to Boston. The letter and its proximate placement allow the reader to gain additional insights that only a first-person account can offer.

Readers cannot overlook the rich captions describing the illustrations. McCullough situates the locations of historical sites in their current context, provides additional details, and draws attention to inaccuracies. For example, below an illustration of Washington's home in Cambridge, Massachusetts, the author describes what is now known as the Longfellow House. In a caption of the iconic painting *The Declaration of Independence* by John Trumbull, the author pens the accuracies and inaccuracies of the work. This and other captions serve as a reminder to the reader of the importance of faithful adherence to the validity of both text and illustrations.

The world of letters is represented in the account of Phillis Wheatley's poem in honor of George Washington. Wheatley was the third woman and the first African American to publish a collection of poems (PBS, n.d.). Washington was humbled by Wheatley's praise and wrote a letter to her expressing his gratitude and admiration.

This edition ends with text situated between two striking portraits of the men who led the two sides, King George III and General George Washington. McCullough concludes by capturing the human and historical significance of 1776:

... for those who carried the fight for independence forward [in] a year of all-too-few victories, of sustained suffering, disease, hunger, desertion, cowardice, disillusionment, defeat, terrible discouragement and fear, as they would never forget,

but also of phenomenal courage and bedrock devotion to country, and that too, they would never forget.” (p. 230)

As a celebration of the patriots, writers, and artists of 1776, enthusiasts of U.S. history will find this book difficult to put down and will return to it often. With each reading new information can be gleaned through the text, illustrations, and artifacts. This captivating version of the original book will be welcomed by students, teachers, and other adults for the enhanced perspectives the arts and letters can offer to the reader. As a result, the uses of the book in a classroom are limitless. Teachers of American history will find a valuable resource for not only recounting and reconsidering the events of 1776 but also for instructing students in the value and use of primary source documents. In addition, opportunities to investigate, analyze, and compare and contrast documents and illustrations are abundant. As a literary resource, this edition of *1776* is an exemplar for the form and content of the nonfiction genre. McCullough’s ability to chronicle events and characters by integrating multiple sources can serve as a model for students. Inspired by the poetry of Phillis Wheatly, students may create poems that chronicle and celebrate other men and women who contributed to the creation and the history of our nation.

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GUIDELINES FOR AUTHORS

The *Journal of Education* is published three times during the calendar year: winter, spring, and fall. The theme of the winter issue varies, the spring issue features the work of early career scholars, and the fall issue focuses on schools and schooling.

MISSION

The mission of the *Journal of Education* is to disseminate knowledge in the service of practice and to expedite the integration of research, theory, and practice in education. Researchers, scholars, teachers, administrators, specialists, and advanced graduate students are invited to submit manuscripts. Each manuscript should inform the education of PK–12 learners or preservice and inservice teachers and other professionals in the field. The manuscript must include a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted).

TYPES OF MANUSCRIPTS

Three types of manuscripts will be considered: reports of original research, explications of theory, and reflections on education.

Reports of Original Research should include a review of the relevant literature, a description of the methodology, a summary of the findings, and a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted).

Explications of Theory should include a clear explanation of a theory that informs practice, a description of the historical context, and a justification based on the literature. The manuscript must include a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted).

Reflections by scholars and professionals who are informed observers of education in classrooms and schools should provide critical analysis and insights regarding effective practice. Experienced researchers may offer historic analysis of a significant topic of inquiry and the effects on the field, as well as insights into implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted).

MANUSCRIPT SUBMISSION

The manuscript should represent original work, not published previously in print or electronic form. The text should be approximately 25 pages long, double spaced, in 12 pt. Times New Roman typeface, and introduced with a 100-word abstract. There should be a one-inch margin on all sides of an 8½ × 11-inch page. The manuscript should conform to the style specifications of the American Psychological Association as described in the *Concise Rules of APA Style, Sixth Edition*, published by the Association in 2009. The text should be submitted as an attachment in electronic form in Microsoft Word format to: bujed@bu.edu.

Consistent with the policy of blind review, the author(s)' name(s) should be listed only on a cover sheet that will be removed before the manuscript is sent to the reviewers. The cover sheet should include: the author(s)' name(s) and institutional affiliation(s) and the first author's mailing address, telephone number, and e-mail address. References to the author(s)' previous work should be listed as Author(s) in the citations and references. Acknowledgment of cooperating scholars or professionals and funding sources should be added to the end of the manuscript.

MANUSCRIPT REVIEW AND SELECTION

The first author will receive a notice of receipt of the manuscript within two weeks and the reviewers' response within three months. Four types of decisions are made: Accept as submitted, Accept with revisions, Revise and resubmit, or Not accepted.

All manuscripts will be judged on the significance of the content, the inclusion of a valid discussion of implications for practice in the broader field of education, and the clarity and cohesion of the text.

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CALL FOR PAPERS

The *Journal of Education* is published three times during the calendar year: winter, spring, and fall. The theme of the winter issue varies, the spring issue features the work of early career scholars, and the fall issue focuses on schools and schooling. Following are the current Calls for Papers. The Guidelines for Authors (p. 55) describe the mission of the *Journal*, the types of articles that are published, and procedures for manuscript submission and review.

Volume 195, Number 3

Schools and Schooling Issue

Articles on the education of PK through secondary-level learners and preservice and inservice teachers and other professionals in education will be featured in this issue. Three types of manuscripts will be considered: reports of original research, explications of theory, and reflections on education. All manuscripts must include a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted). Topics of interest include: instruction, assessment, curriculum, classroom discourse, administration and supervision, counseling and other services, and standards. Manuscripts should be submitted by May 1, 2015.

Volume 196, Number 1

Culturally and Linguistically Diverse Learners

Articles on the education of PK through secondary-level culturally and linguistically diverse learners, and preservice and inservice teachers and other professionals in education who work with these learners will be featured in this issue. Three types of manuscripts will be considered: reports of original research, explications of theory, and reflections on education. All manuscripts must include a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted). Topics of interest include: social justice, equity, opportunity, identity, culturally-responsive pedagogy, instructional congruence, cultural sensitivity, cultural pluralism, sociocultural and sociolinguistic factors, funds of knowledge, family engagement, and community outreach. Manuscripts should be submitted by September 1, 2015.

Volume 196, Number 2

Early Career Scholars Issue

This annual issue features the work of scholars who are in the early years of their academic/professional careers. As with all issues of the *Journal*, manuscripts on the education of PK through secondary-level learners and preservice and inservice teachers and other professionals in education are invited. Three types of manuscripts will be considered: reports of original research, explications of theory, and reflections on education. All manuscripts must include a discussion of implications for practice in the broader field of education (i.e., beyond the particular educational setting in which the work was conducted). Manuscripts should be submitted by January 1, 2016.

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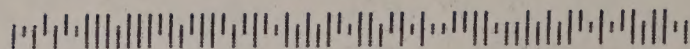
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